07M1B42

MP MASTER
MA34620

GOULD
Electronics

A3 = 11" x 7"
A4 = 8½ x 11"

GOULD
Electronics

SERVICE
PH # 312-C40-4380

MANUAL PART NO.
80-60000-00S

GOULD 60000 SERIES
X-Y RECORDER
ALL MODELS
SERVICE MANUAL

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All information contained in this manual is the latest product information available at the time of printing. The right is reserved to make changes at any time without notice.

Not all parts listed in this manual are available from Gould Inc., Recording Systems Division.

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Gould Inc., Recording Systems Division
3631 Perkins Avenue, Cleveland, Ohio 44114

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GOULD
Electronics

WARRANTY

CURRENT EQUIPMENT:

The Gould Recording Systems Division's products as shown in the Current Equipment Catalog are warranted for a period of one year from date of shipment to original purchaser. They are warranted to conform to the applicable published specifications in effect at the time of shipment, and to be free from any defects in material or manufacture when used with recommended Gould associated equipment and Gould chart paper. LIABILITY OF THE GOULD RECORDING SYSTEMS DIVISION UNDER SUCH WARRANTY IS LIMITED TO SERVICING OR REPLACING DEFECTIVE PARTS EXCEPT PENS, STYLI, FUSES AND BATTERIES AND DOES NOT INCLUDE CALIBRATION AND MINOR MAINTENANCE AS OUTLINED IN GOULD OPERATING MANUALS. (Exceptions: The thermal pen in the 110 Strip Chart Recorder is guaranteed for life. The magnetic head assemblies in the Tape Recorder are warranted for 1000 hours of use or (1) one year from date of first shipment whichever occurs first.) IN NO EVENT SHALL THE GOULD RECORDING SYSTEMS DIVISION BE LIABLE UNDER ANY CIRCUMSTANCES, FOR ANY LOSS OF PROFITS OR OTHER CONTINGENT, CONSEQUENTIAL OR SPECIAL DAMAGES. Units are to be returned transportation prepaid by the buyer. The Gould Recording Systems Division will have the right of final determination of the cause and existence of a defect under this warranty. This warranty shall not apply to any products which have been subjected to misuse, improper installation, repair, alteration, neglect, accident, inundation, fire or operation outside their published maximum ratings. THE FOREGOING WARRANTY IS EXCLUSIVE AND EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS AND OF ANY OTHER OBLIGATION AND SHALL CONSTITUTE THE SOLE REMEDY OF THE BUYER AND SOLE LIABILITY OF THE SELLER.

Gould offers an Extended Warranty Contract for all Recording Systems Division's products manufactured in the Cleveland Perkins' facility, along with calibration traceable to NBS. Please contact the Service Center listed below for details before your warranty expires.

REPLACEMENT PARTS: **Same as above -- except ninety (90) days from date of shipment.**

If a defect occurs:

1. Notify your nearest RSD Service Center (see below), giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data or shipping authorization and instructions will be forwarded to you.

2. On receipt of the shipping authorization, forward the instrument prepaid to location indicated on shipping authorization.

Compliance with the above procedure will assure the earliest repair and return of your equipment.

REFER TO REAR COVER FOR SERVICE CENTER LOCATIONS.

Gould instruments are individually tested and calibrated before shipment to assure dependability and verify their accuracy. To this procedure must be added an unseen ingredient of prime importance to you: The Gould concept of continuing service. Gould responsibility for each instrument sold covers far more than its delivery. Of equal concern is the equipment's suitability for its intended purpose, its correct installation, instruction of operating personnel -- plus future servicing and maintenance. The Gould Field Service Department offers customers any or all of these services:

Field Service

- o Installation
- o Field maintenance
- o NBS Certification

Training

- o Instruction of operators
- o On-site training seminars
- o Formal Training courses

Service Contracts

- o Fixed Fee
- o Time and Material
- o Extended Warranty

Our Seal of Pride Gould Inc., Recording Systems Division, and its predecessor organizations tracing back to Charles F. Brush, have been preeminent in instrumentation development since the 1920's. Among Gould's many achievements is a series of the world's best performing, most versatile, and reliable direct writing recording systems.

Today, Gould recorders and signal conditioners are the overwhelming choice for recording analog signals in the most critical industrial, scientific, and biophysical measurement applications. Whether recording the faintest life signals of a patient in a hospital operating room or the most critical variables in the lab or on the production line, you can depend on the accuracy, faithfulness, clarity, and permanence of the traces made by a Gould recorder.

Innovative design, coupled with highest quality, are hallmarks of all Gould products.

The Field Service Engineer Gould field service engineers provide on-the-spot assistance whenever and wherever it is required. While every field service engineer is the product of intensive and thorough factory training, you will find that his greatest strength evolves from field experience and his knowledge of your objectives. He is aware of your problems, is willing and able to assist you in their solution, and is backed by the nation's most experienced organization in recording instrumentation.

Our field service engineers and technicians are daily engaged in the installation, testing, maintenance, repair and inspection of Gould recording systems all over the country. They can provide you with any information about our instruments you may require; if not, they will find the answer to your problem.

Overhaul and Repair Because we service only our own products, our customers can feel confident of prompt, effective results when they turn to Gould Factory Service Centers.

The repair service these centers provide is of particular appeal to those companies that do not operate an instruments repair facility of their own. By designating the nearest Gould Service Center as its maintenance depot, a Gould-equipped company is assured the best chance for continuity of recording instrumentation.

Many companies with their own repair facilities find it more convenient and more truly economical to have their Gould equipment repaired by service contract with the closest Service Center. In addition to enjoying fast turn-around, these companies are spared the expense of carrying an inventory of recorder parts, accessories, and supplies.

Calibration and Certification A small, quiet room in the Standards and Calibration Section at the Gould plant in Cleveland contains precision reference standards just one step removed from the prime reference measurement standards of the United States – at the National Bureau of Standards in Washington. Included in this room which is temperature-controlled within one degree and has a constant relative humidity of 40%, are standards for voltage, frequency (derived from the atomic vibration of caesium), resistance, capacitance -- in fact all basic parameters of electrical measurement. The room is maintained under stabilized conditions 365 days a year.

The calibration practice of all Gould Service Centers is directly traceable to the National Bureau of Standards. We can supply complete calibration for any Gould equipment, and we can also certify to manufacturer's specifications followed by a letter of certification when required.

Training The Gould field service engineer will hold short training courses either on the job or at his facility. On-the-job training is usually a brief, informal session with the people who will actually be operating the Gould equipment.

Formal classroom training is more complete: detailed information, a thorough review of underlying theory, training devices, demonstration of problem solving and examination of students to determine their understanding and proficiency is accomplished at our Cleveland plant.

Contracts Customer companies requiring temporary or permanent service are afforded contract arrangements by which agreed-upon maintenance, repair, upgrading and calibration services are performed on a routine basis. Service contracts are now in effect with a number of customers, affording substantial savings in time and money.

Owing to the various requirements of each customer, we do not reproduce here a standard, boilerplate agreement -- which might contain too much or too little. Instead, we tailor each contract to a particular customer's needs. This practice has singlehandedly produced substantial savings in time and money for others; and it can do the same for you.

An extended warranty is available at the point of sale allowing a regulated budget for the first two years of ownership. You may take advantage of this warranty within the first year of ownership at a percentage of the current listed price.

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Additional information pages or pages that have been removed for any reason can be inserted in the correct position by using the page number code.

Example: Page no 2:9·1 is the first page of Sub-section 9(Y axis servo motor assembly) situated in Section 2 (Mainframes)

Gould Bryans Instruments Limited
Willow Lane, Mitcham, Surrey CR4 4UL.
Telephone: 01-640 3490. Telex: 946097

GOULD
Electronics & Electrical Products

Our ref: 869.022.0035
Your ref:

Dear Customer,

To help Gould Bryans to keep you right up to date with amendments to your series 60000 maintenance handbook, please confirm its arrival at your Establishment, and also send full details of the person responsible for your revision service. Your handbook contains all the latest information on arrival and the above details will ensure that you have all documentation and amendments at your fingertips when you need them.

Yours faithfully,
Gould Bryans Instruments Ltd.

Technical Publications Department

To **TECHNICAL PUBLICATIONS DEPARTMENT**

GOULD BRYANS INSTRUMENTS LIMITED,
Willow Lane, Micham, Surrey CR4 4UL, England.

Receipt of 60,000 maintenance handbook

Date of arrival

Company Address

Responsible person

Department

Date

Signed

Gould Bryans Instruments Limited
Willow Lane, Mitcham, Surrey CR4 4UL
Telephone 01-640 3490 Telex 946097

GOULD
Electronics & Electrical Products

60000 Maintenance

Amendment Record

Amendment	Incorporated by	Date	From serial No.	Further information
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Gould Bryans sales and service centres

Head Office and Main Service Centre –

Gould Bryans Instruments Ltd.
1 Willow Lane,
Mitcham
Surrey.

Tel: 01 640 3490
Telex: 946097

Administration, Sales, Spares,
Service Enquiries.

Scottish Service Centre –

Lowtech (Electronics) Ltd.
Flemington Road,
Glenrothes,
Fife

Service

Tel: 0592 758792

Gould Inc.
Instruments Division,
35129 Curtis Blvd.,
Eastlake,
Ohio 44094
U.S.A.
Tel (216) 361 3315
Telex 810 421 8580

Gould Advance GmbH
Mauerbachstrasse 24,
1140 Vienna
Austria
Tel (0222) 97 25 06
Telex 1-31380

Gould Elektronik AG
Grubenstrasse 56
8045 Zurich
Switzerland
Tel 01-35 2766
Telex 58521

Gould Instruments S.A.F.
57, Rue Saint-Sauveur,
91160 Ballainvilliers.
France.

Gould Instrument Systems
Dieselstrasse 5-7
6453 Seligenstadt 3
West Germany
Tel (06182) 21091-95
Telex 4184556

Sales and service agents are also located in –

The Arab World
Australia
Benelux
Denmark
Finland
Greece
Holland
India
Indonesia
Iran
Iraq
Italy
Malaysia
Mexico
New Zealand
Norway
Singapore
Spain
Sweden
Turkey
U.S.S.R.

Phone Gould Bryans for the address of your nearest agent.

General information

1) Maintenance of the series 60000 recorders should only be attempted by persons skilled in maintenance and repair techniques.

2) Read the entire instruction for the assembly to be repaired before attempting maintenance to understand the procedure fully — if in doubt contact Gould Bryans (or their Agents) for advice by fully trained Engineers.

3) Throughout these instructions cross referencing is by —

   a) assembly code number. — this number is the identification of the assembly concerned and is the order code for that assembly as well as the identification number for Gould Bryans drawings. When discussing an assembly, it will help Gould Bryans Engineers to exactly identify the appropriate part if you quote this number.

   b) exploded drawing line number, — this number is always referred to the exploded drawing for the recorder so that a part can be located and identified readily.

4) Certain assemblies require a high degree of specialisation for repair work. These should be replaced as complete assemblies and therefore no details for repairs are given. Advice on some repairs for these assemblies may be available but check with Gould Bryans Service Department before commencing repair work.

5) Do not force assemblies together or apart. If excessive force is required it is unlikely that the repair is being carried out correctly.

6) Always disconnect the recorder from the mains electricity supply before attempting **any** work on the recorder.

7) Scratches or punctures on the surface of the electrostat bed-plate may expose high voltage conductors. Should this occur DO NOT OPERATE THE INSTRUMENT.

8) Do not obstruct the gantry or pen carriage nor attempt to change their positions manually unless the mute condition is selected.

9) Always select either 'mute' or 'normal' servo modes when setting up a system or when adjustments to the signal source are likely to be prolonged. Continuous high speed operation even with the pen raised could cause the motor protection circuit to operate.

10) The series 60000 recorders have been designed to comply with the safety requirements for Electronic Measuring Apparatus B.S. 4743 (IEC 348).

Basic maintenance

1. Cleaning the recorder

Ensure that the recorder is disconnected from the mains supply when cleaning it. Keep the painted surfaces of your recorder clean by wiping with a damp (not wet) cloth. If too wet, water may get into inside of recorder.

To remove ink stains or stubborn grime use an industrial alchol (some proprietary cleaners may prevent the electrostatic holddown from operating correctly). *Note* if your national law prohibits the use of such solvents contact your Gould Bryans Agent for advice.

2. Replacement of fuses

Fuses should only be replaced with the correct type and rating. Never replace a fuse more than once without locating the cause of the failure.

Symptoms

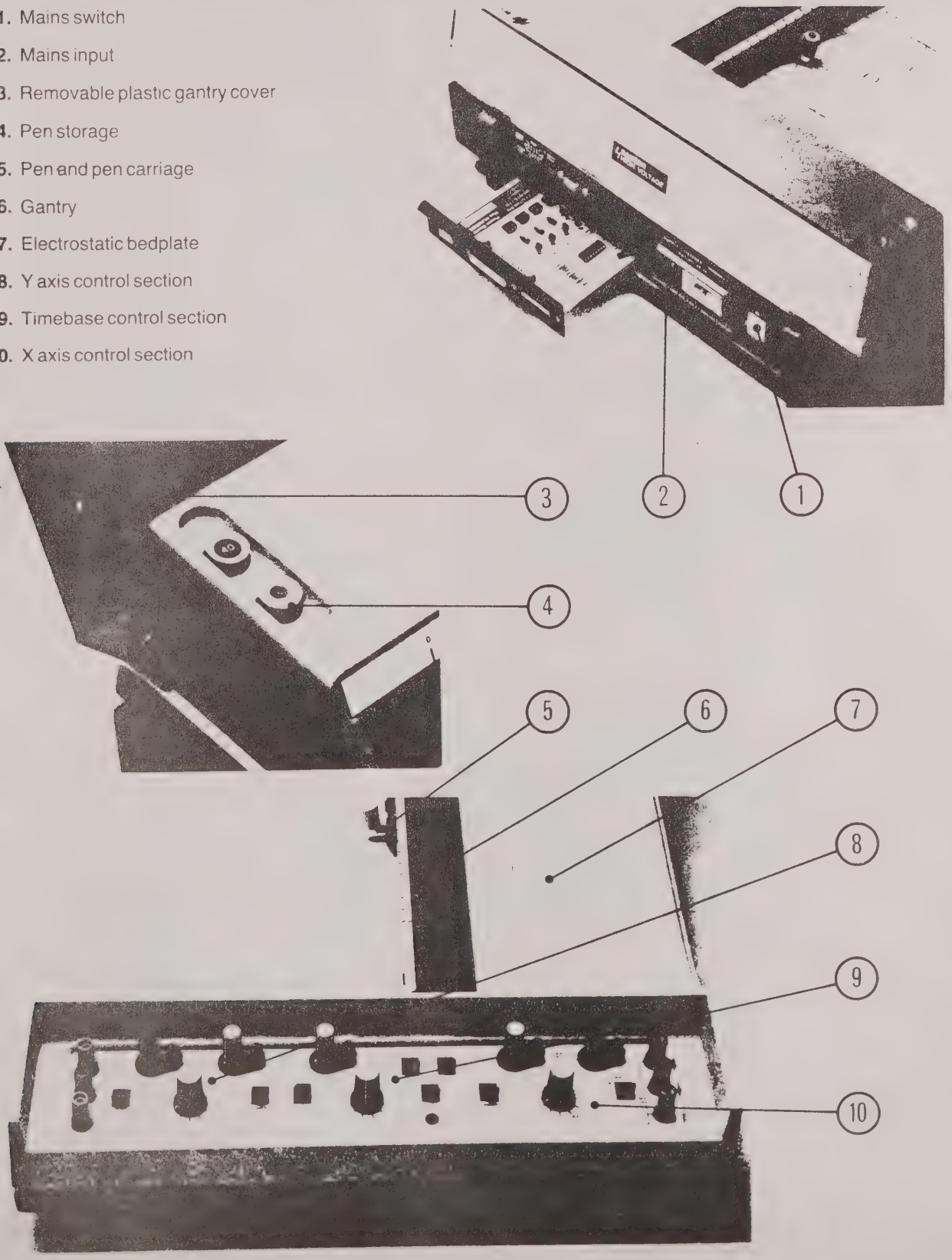
If the mains fuse breaks the recorder will appear as though disconnected from the mains supply – on both single and double fuse versions, the fuses are located in the mains input socket at the rear of the recorder.

3. Lubrication

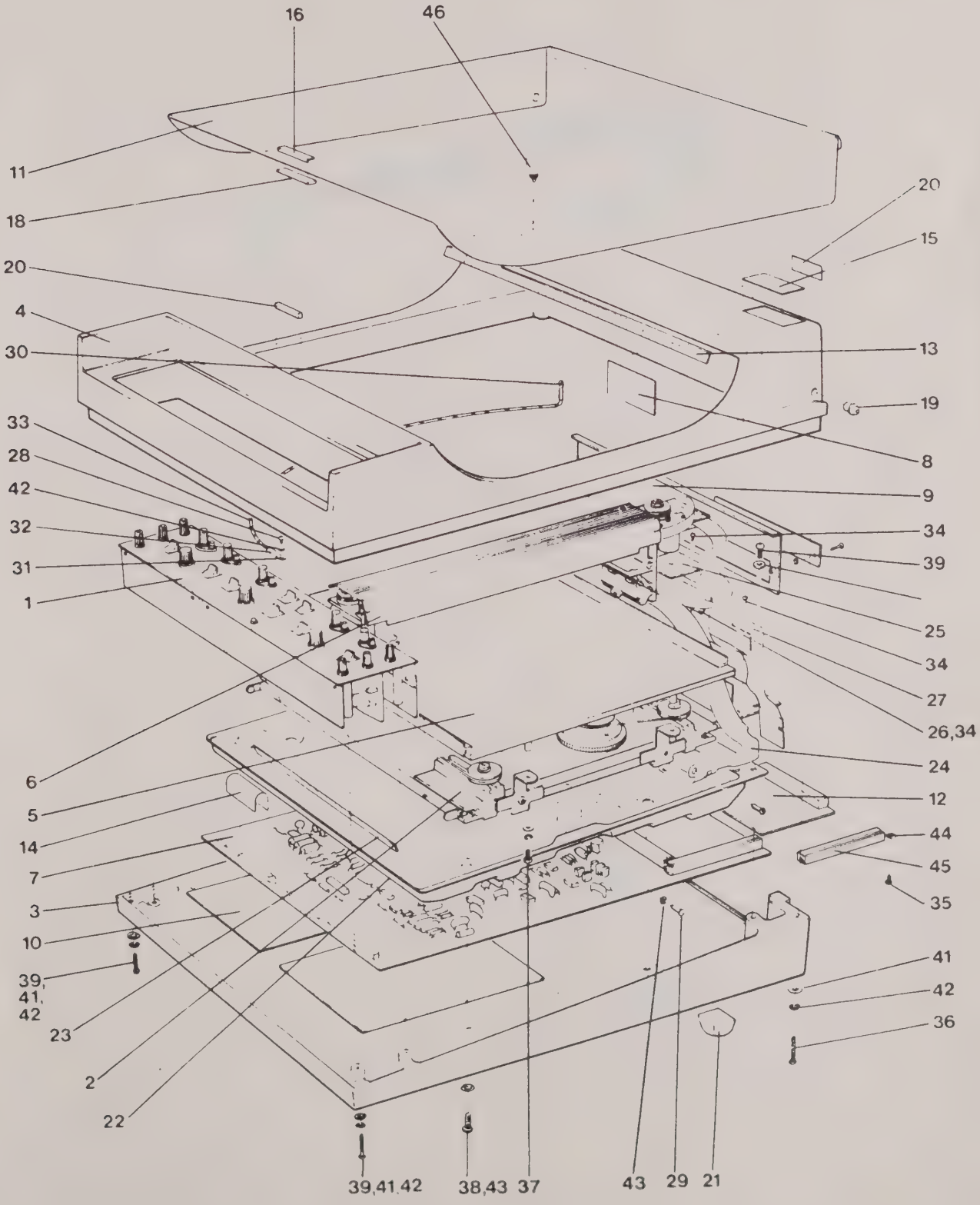
Should it be required to clean greasy dirt from the guide bars use a cleaning solvent and then wipe a light film of the oil available from Gould Bryans on the guide bars.

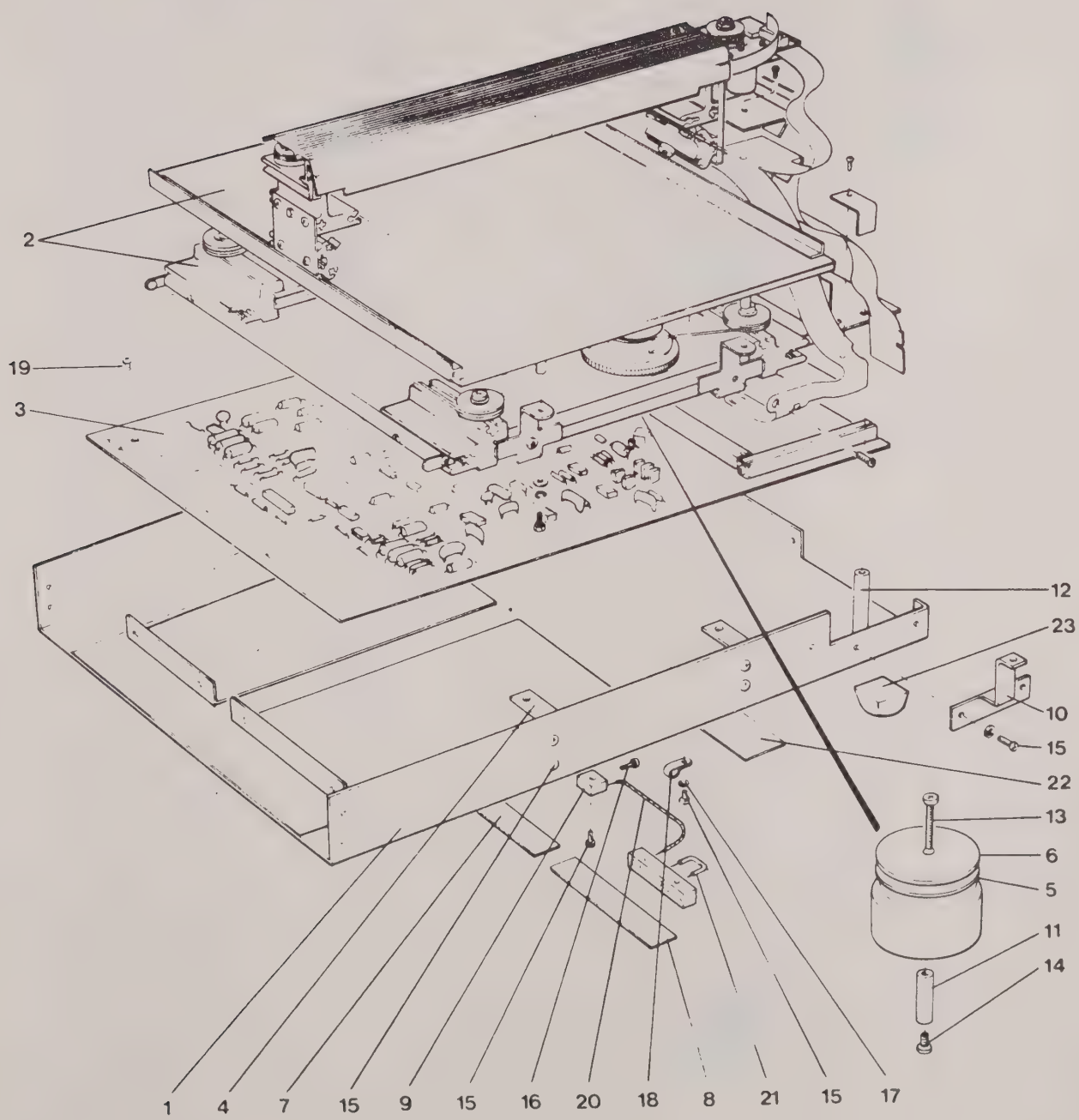
Location of recorder parts

1. Mains switch
2. Mains input
3. Removable plastic gantry cover
4. Pen storage
5. Pen and pen carriage
6. Gantry
7. Electrostatic bedplate
8. Y axis control section
9. Timebase control section
10. X axis control section



Exploded illustration — 60000

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Exploded illustration parts list — 60000

A3 & A4 Systems and Multi Range

Item	Description	Code No.	Qty
1	Front Panel Assembly (Multi Range)	60000/1	1
	Front Panel Assembly (Systems)	60120/1	1
2	Mainframe Sub Assembly (A4)	60010/9	1
	Mainframe Sub Assembly (A3)	60020/9	1
3	Base Moulding (A4)	60010/502	1
	Base Moulding (A3)	60020/502	1
4	Lid Moulding (A4)	60010/503	1
	Lid Moulding (A3)	60020/503	1
5	Electrostatic Bedplate Assy (A4)	50010/10	1
	Electrostatic Bedplate Assy (A3)	60020/10	1
6	Gantry Assembly (A4)	60010/12	1
	Gantry Assembly (A3)	60020/12	1
7	Main PCB (Multi Range)	60020/2	1
	Main PCB (Systems)	60120/2	1
8	Model Identification Label	28800 578	1
9	Back Panel Assembly	60000 14	1
10	Screen Plate Assembly	6000/66	2
11	Dust Cover (A4)	60010/504	1
	Dust Cover (A3)	60020/504	1
12	Extender PCB Assembly (A3)	60020/51	1
13	X Axis Scale Bar (A4)	60010/519	1
	X Axis Scale Bar (A3)	60020/519	1
14	Film Strip	450 000 0174	3
15	Label – Gould – USA	60000 605	1
	Label – Gould Bryans – UK	60000/606	1
16	Cover Plate	60000/578	1
17	Warning Label	60000/581	2
18	Magnetic Catch Plate	60000/588	1
19	Hinge Stud	60000 73	2
20	Magnet	369 000 0012	1
21	Rubber Foot	752 000 0015	4
22	Protective Cover (A4)	60010 520	1
	Protective Cover (A3)	60020 520	1
23	Pot Label	60000 590	1
24	X Axis Film Wire	60000 577	1
25	Film Wire Guide	60000 546	1
26	Film Wire Clamp	60000/65	1
27	Film Wire Clip	60000 575	1
28	Screw M3 x 6 Pozi Pan		1
29	Screw M4 x 6 Pozi Pan		2
30	Solder Tag M4 Tinned		1
31	Solder Tag M3 Tinned		1
32	Sleeve H15 x 20		2
33	Earth Wire	450 000 0010	A R
34	Screw M3 x 6 Pozi Pan		3
35	Screw M3 x 12 Pozi Pan (A3)		4
36	Screw M3 x 25 Pozi Pan		2
37	Screw M3 x 12 Hex Head		4
38	Screw M4 x 14 Pozi Pan		4
39	Screw M4 x 5 Pozi Pan		2
40	Screw M3 x 16 Pozi Pan		4
41	Washer M3 Plain		21
42	Washer M3 Single Coil		21
43	Washer M4 Plain		8
44	Nut M3 Square (A3)		4
45	PCB Guide (A3)	60020/527	2
46	Pen – Red	369 011 0020	1
	Pen – Black	869 011 0021	1
	Accessory Kit	60000 75	1

A3 & A4 OEM.

Item	Description	Code No.	Qty
1	Chassis Assembly	60071 1	1
2	Mainframe Assembly (A4)	60010/1	1
	Mainframe Assembly (A3)	60020/1	1
3	Main PCB (OEM)	60050/2	1
	Mainframe Bracket	60071/58	3
5	Transformer Packing Ring	60000/542	1
6	Transformer Clamp Plate	60000/543	1
7	Rating Label	60071/504	1
8	Mains Connection Label	60050/501	1
9	Earth Terminal	50600/510	1
10	Offset Mainframe Bracket (A3)	60071/511	1
11	Spacer Type C M4 x 33 Lg	–	1
12	Spacer Type C M4 x 67 Lg (A4)	–	2
13	Screw M4 x 30 Lg Pozi Pan	–	1
14	Screw M4 x 8 Lg Pozi Pan	–	9
15	Screw M3 x 8 Lg Pozi Pan	–	11
16	Screw M3 x 8 Lg Ch Hd	–	2
17	Washer M3 Plain	–	3
18	"P" Clip N x 2	670.009 0007	1
19	Screw M3 x 6 Pozi Pan	–	4
20	Wire 30/0.2 GN/Y	450.000 0010	A R
21	Wire 16/0.2 R/B	450.144.1436	A R
22	Model Identification Label	28800/578	1
23	Rubber Foot	752.000.0015	4
24	Accessory Kit (OEM)	60050/63	1

Tools required for 60000 maintenance

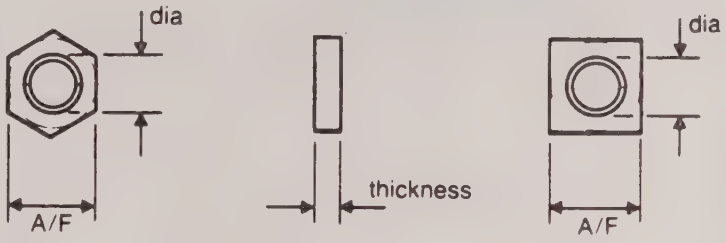
Screwdriver	–	Small, suitable for slotted grub screws
Screwdriver	–	Suitable for M3 slotted screws.
Screwdriver	–	Pozidriv No. 1
Screwdriver	–	Pozidriv No. 2
Spanner	–	5.5 A/F Open ended
Spanner	–	7 A/F Open ended
Spanner	–	8 A/F Open ended
Spanner	–	10 A/F Open ended
Allen Key	–	3 A/F
Pliers	–	Taper nosed
Side cutters		
Soldering iron	–	Less than 30W
Meter	–	To measure resistance but multimeter would be an advantage.
Gram gauge	–	0 – 100 gms

Reference information (Nuts, Screws etc.)

Sizes given do not necessarily indicate that the item is used on your recorder.
All dimensions in mm.

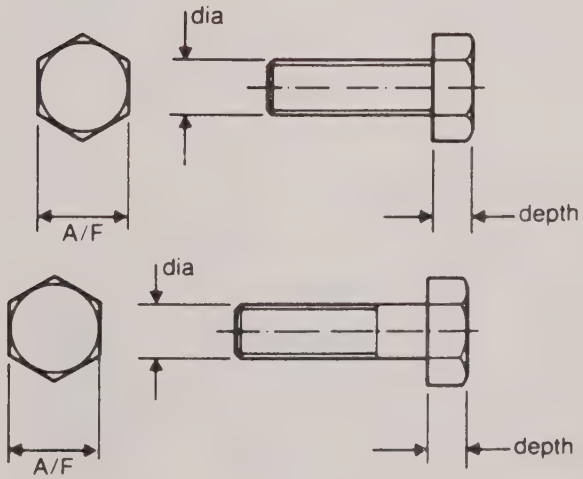
Nuts

Diameter	Across flats	Thickness
M3	5.50	1.60
M3.5	6.00	2.00
M4	7.00	2.00
M5	8.00	2.50
M6	10.00	3.00



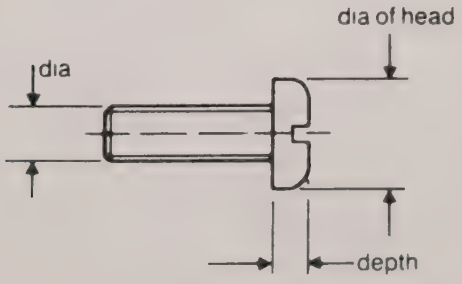
Hexagon setscrews and bolts

Diameter	Across flats	Depth of head
M2	4.00	1.40
M2.5	5.00	1.70
M3	5.50	2.00
M4	7.00	2.80
M5	8.00	3.50
M6	10.00	4.00



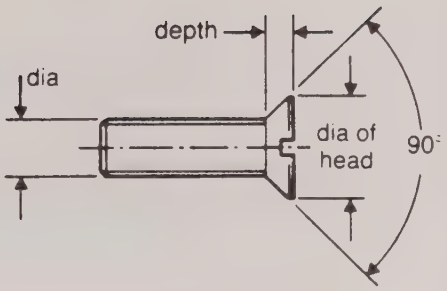
Slotted machine screws, pan head

Diameter	Dia of head	Depth of head
M2	4.00	1.20
M2.5	5.00	1.50
M3	6.00	1.80
M3.5	7.00	2.10
M4	8.00	2.40
M5	10.00	3.00
M6	12.00	3.60



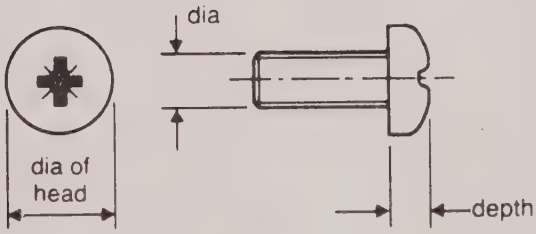
Slotted machine screws, countersunk head

Diameter	Dia of head	Depth of head
M1	2.20	0.60
M1.6	3.52	0.96
M2	4.40	1.20
M2.5	5.50	1.50
M3	6.30	1.65
M3.5	7.35	1.93
M4	8.40	2.20
M5	10.00	2.50
M6	12.00	3.00



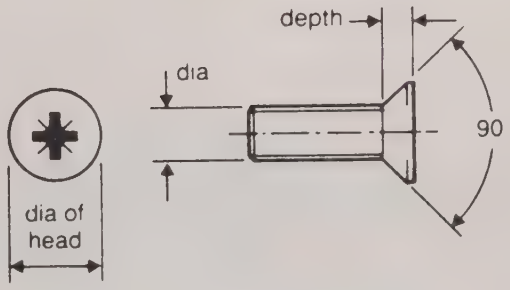
Pozidriv machine screws, pan head

Diameter	Dia of head	Depth of head	Driver No
M2	4.00	1.60	1
M2.5	5.00	1.75	1
M3	6.00	2.10	1
M3.5	7.00	2.45	2
M4	8.00	2.80	2
M5	10.00	3.50	2
M6	12.00	4.20	3



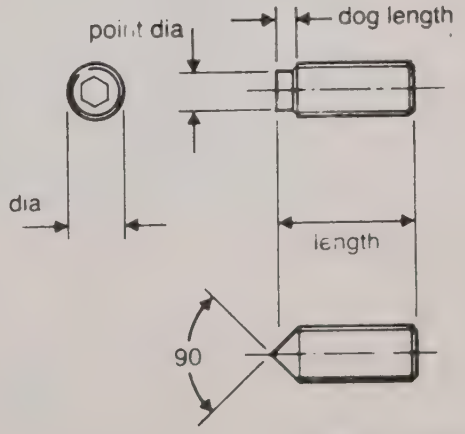
Pozidriv machine screws, countersunk head

Diameter	Dia of head	Depth of head	Driver No
M2	4.40	1.20	1
M2.5	5.50	1.50	1
M3	6.30	1.65	1
M3.5	7.35	1.93	2
M4	8.40	2.20	2
M5	10.00	2.50	2
M6	12.00	3.00	3



Socket setscrews

Diameter	Point dia	Dog length	Nominal key size	Cone point angle
M3	2.00	0.88	1.50	5
M4	2.50	1.12	2.00	6
M5	3.50	1.38	2.50	8
M6	4.00	1.62	3.00	9



S/N TB-182-T
S/N TB-203-T

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A3 = 11" x 17" SIZE GRAPHS
A4 = 8½" x 11" " "

GOULD Bryans

Section 2:1 Mainframe

SERVICE
PH# 312-640-4380

Series 60000 X Y recorder maintenance instructions.

Assembly code:	**60010/9 (A4) 60020/9 (A3)**
Exploded illus. line no:	**2**
Used on models:	**All**

TRI-Flow Lubricant

Mainframe

Section 2:1

Information contained in this section

Mainframe assembly – Removal and replacement

Guide bars – Removal and replacement

X axis potentiometer – Removal and replacement

Bedplate mounting brackets – Removal and replacement

Pulleys – Removal, replacement and adjustment

X axis film wire – Removal and replacement

Tools required for maintenance of this assembly:-

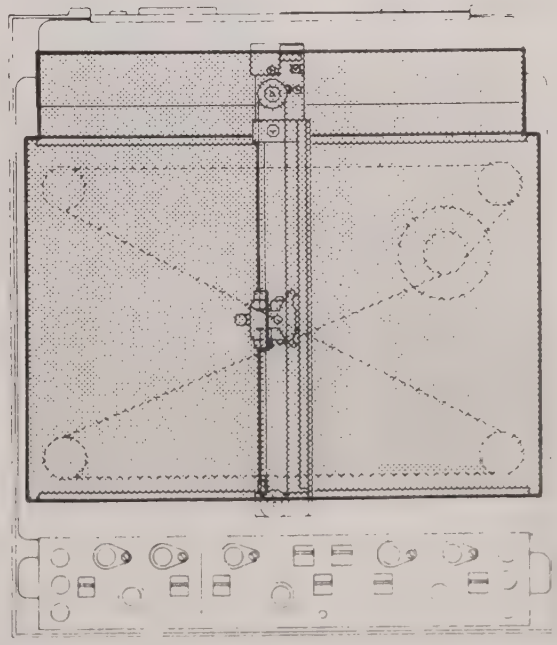
Screwdriver – Small, suitable for slotted grubscrews
Screwdriver – Suitable for M3 screws
Screwdriver – Pozidriv No. 1
Screwdriver – Pozidriv No. 2

Spanner – 7mm A/F open ended
Spanner – 5.5mm A/F open ended

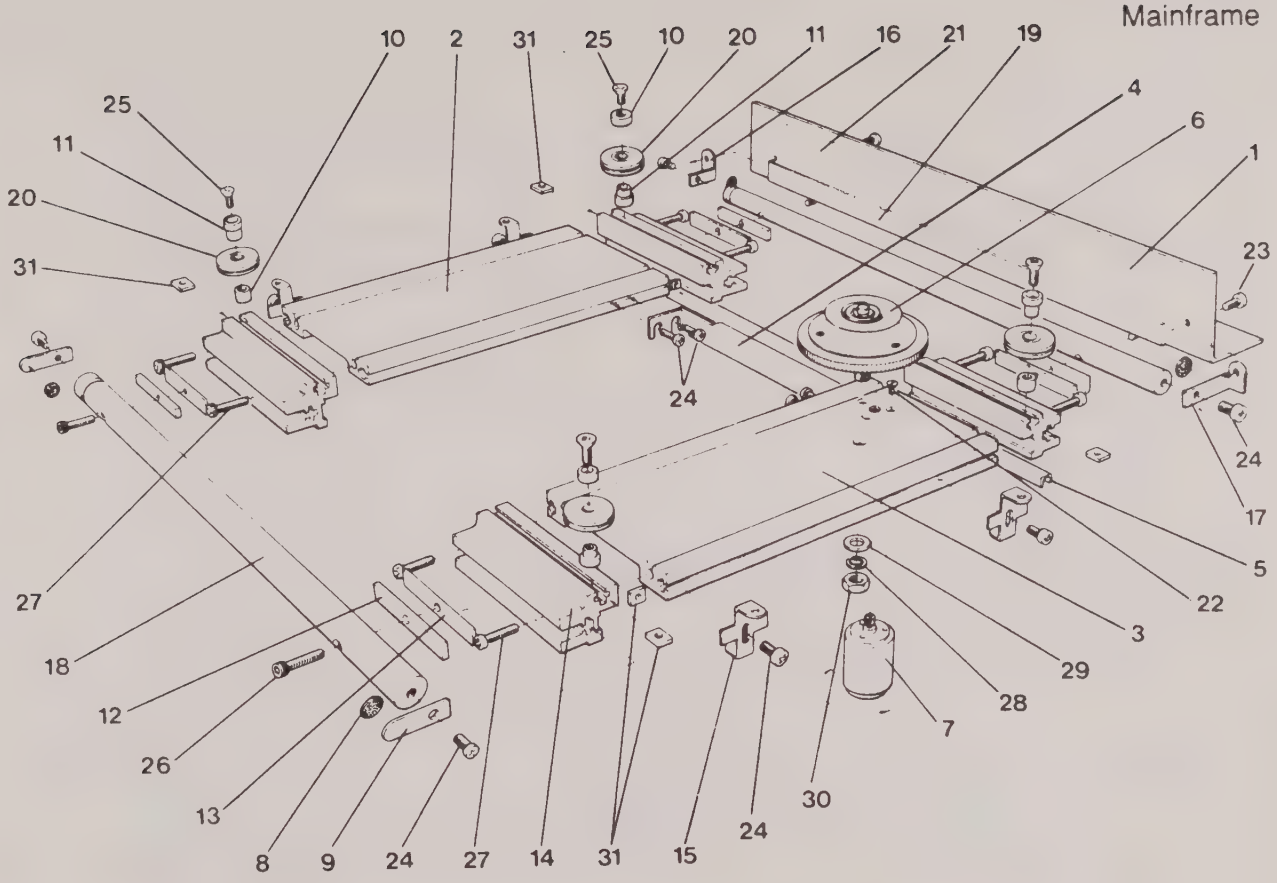
Allen key – 3mm A/F

Soldering iron – Less than 30W

Assembly location:-



View of top of recorder with top cover and gantry cover removed.

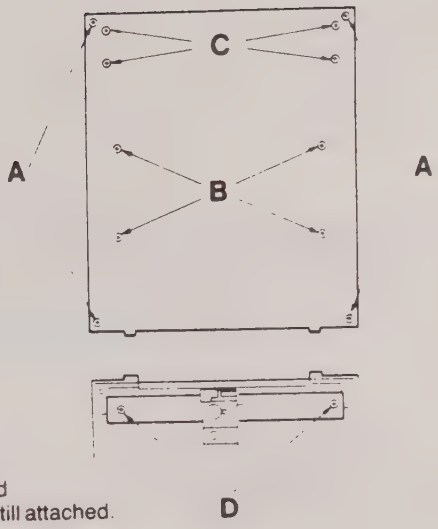


Component List

Item	Component Description	Code No.	Qty
1	Rear Guard (A4)	60010/62	1
	Rear Guard (A3)	60020/62	1
2	Cross Member – Left-hand (A4)	60010/513	1
	Cross Member – Left-hand (A3)	60020/513	1
3	Cross Member – Right-hand (A4)	60010/514	1
	Cross Member – Right-hand (A3)	60020/514	1
4	X Axis Potentiometer Support (A4)	60010/517	1
	X Axis Potentiometer Support (A3)	60020/517	1
5	Potentiometer Assembly (A4)	60010/61	1
	Potentiometer Assembly (A3)	60020/61	1
6	X Axis Drive Assembly	60000/61	1
7	Servo Motor	60000/50	1
8	Buffer Stop	60000/531	4
9	Limit Stop Bracket	60000/532	2
10	X Axis Pulley Spacer	60000/533	4
11	X Axis Pulley Spindle	60000/534	4
12	Spacer Strip	60000/547	4
13	Nut Plate	60000/548	4
14	Guide Bar Mounts	60000/549	4
15	Bed Plate Mounting Bracket	60000/71	4
16	Rear Guard Support (L H)	60000/67	1
17	Rear Guard Support (R H)	60000/68	1
18	X Axis Guide Bar (A4)	60010/508	2
	X Axis Guide Bar (A3)	60020/508	2
19	Spacing Strip (A4)	60010/522	1
	Spacing Strip (A3)	60020/522	1
20	X Axis Pulley Assembly Moulding	50000/50	4
21	Serial No Plate	50000/645	1
22	Screw M2 × 3 Csk		3

Item	Description	Code No.	Qty
23	Screw M3 × 6 Pozi Pan		2
24	Screw M4 × 6 Pozi Pan		12
25	Screw M4 × 16 Pozi Csk		4
26	Screw M4 × 16 Skt Cap		4
27	Screw M4 × 20 Pozi Pan		4
28	Washer M6 Single Coil		1
29	Washer M6 Plain		1
30	Nut M6 Hex		20
31	Nut M4 Square		1

Removal



1 Remove any spare pens in lid assembly.

2 Remove plastic cover by gently easing the sides of cover outwards from hinges.

3 Place recorder upright on rear end supports.

4 Remove screws 'A' from underside of recorder.

5 Lift off lid moulding.

6 Remove four screws 'B' on underside.

7 Lay recorder flat and remove two screws 'D' from film strip retaining bracket (see diagram inset).

8 Note positions of all screws as their lengths vary and correct repositioning is critical.

9 Lift mainframe assembly off base moulding and carefully place to left hand side taking care not to damage connecting wires and film strip which are still attached.

10 Unplug X axis film strip from Skt. 2 on main PCB.

11 Unplug bedplate harness from Skt. 3 on main PCB and disconnect earth line from rear panel.

Replacement

1 Replace mainframe assembly on the base moulding taking care that all wires and film strip are correctly located in Sockets 3 and 2 respectively and that they are not 'pinched' or 'stressed' under the mainframe.
Note: The wire harness and earth wire is fed through a cut out in the main circuit board protective cover (See diagram inset).

2 Reconnect earth wire to rear panel.

3 Replace the two screws 'D'.

4 Place recorder upright on rear end supports taking care to restrain mainframe from any movement.

5 Replace screws 'B'

6 Replace lid moulding and secure with screws 'A'.

7 Place recorder flat and carefully replace plastic cover.

Removal, Replacement and adjustment of main component parts

Guide Bars

Removal

1 Release two screws securing the protective cover and remove.

2 Remove bed plate as described in Section 2, Sub-section 2.

3 Remove gantry assembly as described in Section 2, Sub-section 4.

4 Remove the remaining two screws in the end of the guide bars taking care not to stress the film strip

5 Release the two cap screws in each guide bar and remove.

Replacement – This is a direct reversal of the removal procedure, taking note that the under cut groove in the bar is on the left hand side

Adjustment – None

X axis potentiometer assembly

Removal

1 Release two screws securing the protective cover and remove.

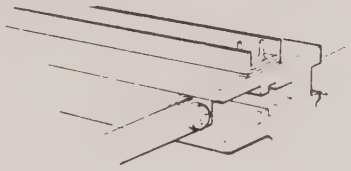
2 Release film strip/bed plate mounting bracket screw

3 Carefuly unsolder and remove film strip from pins on potentiometer assembly.

4 Release single pozidriv screw and remove X axis brush moulding assembly from drive end gantry extrusion and allow to hang free on connecting wire.

5 The potentiometer assembly is secured by double sided adhesive tape and can be removed by prising off. However, this can lead to damage and therefore a new potentiometer assembly should be fitted.

Replacement – This is a direct reversal of removal procedure, however care should be taken to align the pin end of the potentiometer assembly flush with the outside edge of the guide bar mounting extrusion at the film strip end. (See inset illustration)



Adjustment – None

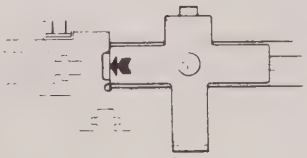
Bedplate mounting brackets

Removal

1 Release two screws securing the protective cover and remove.

2 Release the screws securing the brackets to both the bed plate and mainframe extrusions.

Replacement – This is a direct reversal of removal procedure but note that the edge of each bracket should be located against the edge of the guide bar mounting extrusion (See inset illustration).



Adjustment – None

Pulleys

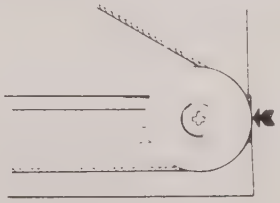
Removal

1 Slacken wire rope tensioner and slip off wire rope from required pulley.

2 Release countersunk pozidriv screw securing the pulley to the mainframe and remove.

Note: Care must be taken to ensure the correct order of assembly as spacers vary according to pulley height and are interchangeable

Replacement – This is a direct reversal of procedure but note that the outer edge of the pulley should be aligned with the outer edge of the mainframe assembly extrusion (See inset illustration).



Adjustment

1 Re-tension wire rope as described in Section 2. Sub-section 3.

Film wire

Removal

1 Release two screws securing the protective cover and remove.

2 Unplug Y axis film wire

3 Release two pozidriv screws to remove X axis film wire end board

4 Unsolder 5 wires making careful note of colour positions

5 Release film wire bed plate mounting bracket screw

6 Carefully unsolder film wire from pins on potentiometer assembly

7 Carefully unsolder connection to X axis servo motor

8 Release one pozidriv screw securing film wire clip to the rear guard.

9 Release one pozidriv screw securing the film wire guide to the rear guard and remove.

10 Care must be taken when handling the film strip as damage may occur

11 The film wire can now be removed from the guide by releasing the pozidriv screw making careful note on how the film wire is folded

12 If required, the rear guard can now be removed from the main frame by releasing the two pozidriv screws at each end

Replacement – This is a direct reversal of removal procedure

Adjustment – None

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Section 2:2 Bedplate and LED assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60010/10 (A4) 60020/10 (A3)**
Exploded illus. line no: **5**
Used on models: **All**

Information contained in this section

Bedplate assembly – Removal and replacement

Wiring harness – Removal and replacement

L.E.D.s. – Removal and replacement

Tools required for maintenance of this assembly:-

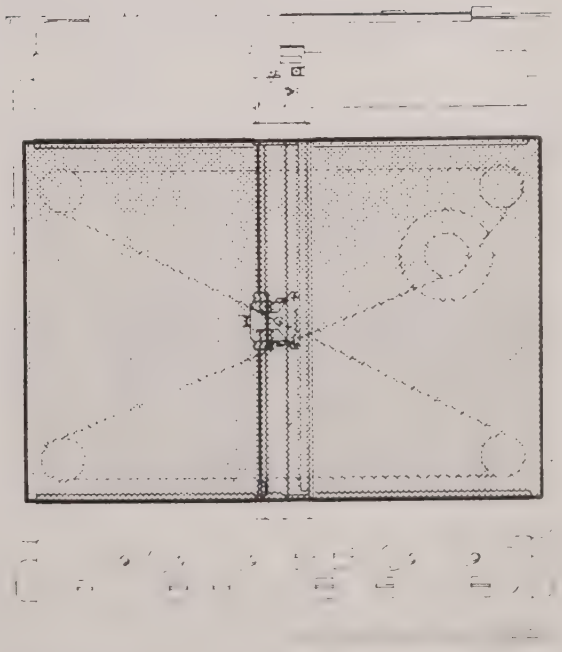
Screwdriver – Pozidriv No. 1

Spanner – 5.5mm A/F

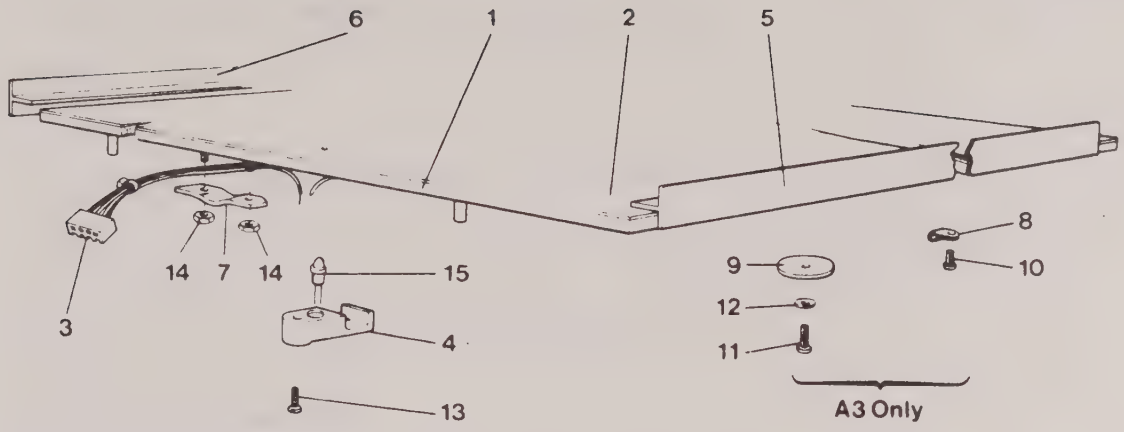
Side cutters

Soldering iron – Less than 30W

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty	Item	Description	Code No.	Qty
1	Bedplate Support (A4)	60010/68	1	6	Pencil Guard – Rear (A4)	60010/591	1
	Bedplate Support (A3)	60020/68	1		Pencil Guard – Rear (A3)	60020/591	1
2	Electrostatic Bedplate			7	Clamp Strip	60000/586	1
	Sub-Assy (A4)	60010/67	1	8	'P' Clip (A3 only)	670 009.0006	1
	Electrostatic Bedplate			9	Wire Spacer (A3 only)	60020/599	1
	Sub-Assy (A3)	60020/67	1	10	Screw M3 × 5 (A3 only)		1
3	Harness Assembly	60000/70	1	11	Screw M3 × 8 (A3 only)		1
4	LED Retainer	60000/594	3	12	Washer M3 Plain (A3 only)		1
5	Pencil Guard – Front – (A4)	60010/510	1	13	Screw M3 × 10 Pan Hd.		3
	Pencil Guard – Front – (A3)	60020/510	1	14	Nut M3 Hex		2
				15	LED	336 004.0011	3

Removal

1 Remove plastic cover, lid moulding and mainframe assembly as described in Section 2, Sub-section 1.

2 If fitted, cut off nylon cable tie on bedplate harness to release main earth wire.

3 Unscrew the four hexagonal screws securing the bedplate to the mainframe.

4 Move gantry to far right hand side of bedplate.

5 Carefully slide bedplate to the left and remove.

Replacement

1 Making sure that the gantry is at the far right hand side, slide the bedplate under the gantry onto the locating brackets.

2 Re-fit the four hexagonal screws loosely to allow lateral movement of the bedplate

3 Fit pen into the pen holder and align pen tip with lower Left-Hand graticule, then check alignment over Right-Hand graticule.

4 If the bedplate proves to be out of alignment, use the movement in the beplate mounting to allow alignment of lower left and right hand graticules to be achieved.

5 When alignment is correct, tighten the four hexagonal screws.

6 Refit mainframe assembly and connecting wires as described under 'Replacement' in Section 2, Sub-section 1.

Removal, replacement and adjustment of component parts

Harness

Removal

1 Unsolder wires from all LED pins and two terminals on electrostatic board making carefull note of wire positions for reassembly.

2 Release M3 hexagonal nuts and remove wire clamp strip. The harness can now be carefully fed through the LED retainers and removed.

Replacement – This is a direct reversal of removal procedure.

Adjustment – None

Light Emitting Diodes (LED)

Removal

1 Unsolder the wire connections to the relevant diode, release the M3 pozidriv pan head screw and remove LED retainer. The LED can now be lifted from its 'D' shaped locating hole.

Replacement

1 Ensure that that the LED is correctly located in the 'D' shaped hole (this ensures that the anode and cathode pins are aligned to the hardness.

2 Refit retainer and resolder connections.

Adjustment – None

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Section 2:3
X axis wire rope

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60010/66 (A4) 60020/66 (A3)**
Exploded illus. line no:
Used on models: **All**

Information contained in this section

Wire rope assembly – Removal and replacement

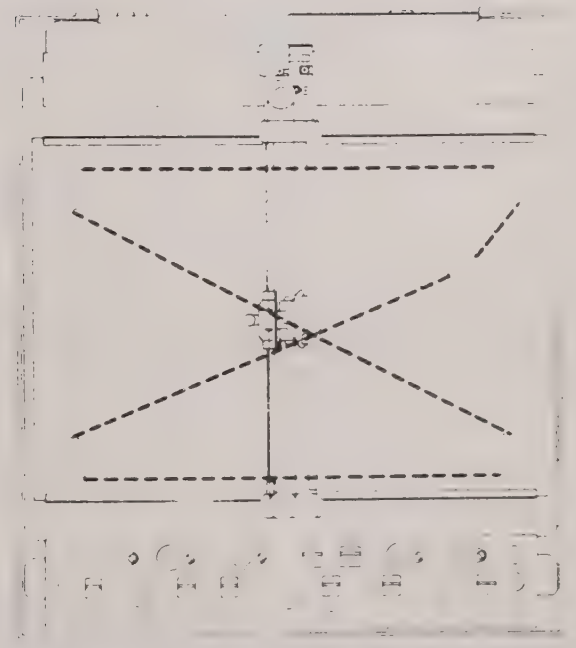
Tools required for maintenance of this assembly:-

Screwdriver – Pozidriv No. 1
Screwdriver – Suitable for M3 screws

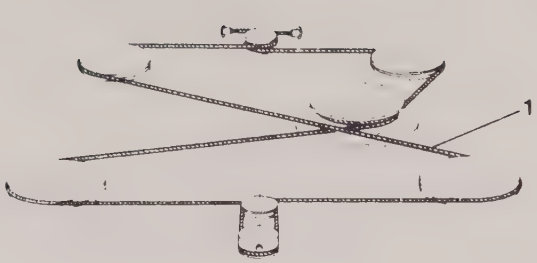
Spanner – 5.5mm A/F open ended

Gram Gauge – 0-100 gms

Assembly location:-



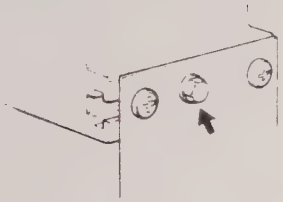
View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty
1	X Axis Wire Rope Assy		
	(A4)	60010 66	1
	(A3)	60020 66	1

Removal



1 Remove mainframe as described in Section 2 Sub-section 1.

2 Remove bedplate assembly as described in Section 2 Sub-section 2.

3 Slacken the two grub screws on either side of both the gantry ends.

4 Slacken the cable adjusting screw on the free end gantry. (See inset diagram) sufficiently to release the cable.

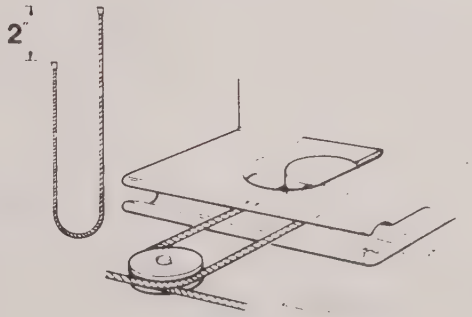
5 Remove cable from all four corner pulleys.

6 After removing completely the two grub screws on the drive end extrusion, slide out the pulley. The cable ends can now be removed.

7 Remove **one** of the grub screws completely from the free end extrusion and slide out the **outer** pulley

8 Unhook wire from the **inner** adjusting pulley on free end extrusion.

Replacement



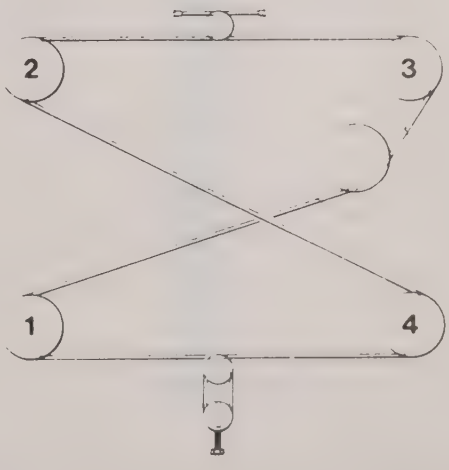
1 Assertain the centre of the wire rope, then allow the right hand side of the loop to be 2" longer than the left. (See inset illustration).

2 With the brass tensioning pulley in its slackest position, feed the wire rope loop through the slot in the free end extrusion and onto the groove of the tensioning pulley.

3 Place aluminium pulley between the two sides of the wire rope, pull to one side and feed into slot in free end extrusion – Refit grub screw loosely.

4 Feed right hand side of wire rope around pulley, under left hand side and hook under pulley 1.

5 Bring diagonally across and round scroll anti-clock wise one complete turn, hook under pulley 3 and hold.



6 Take left hand side of wire rope to pulley 4 and hook under.

7 Take rope diagonally across, above right hand rope, to pulley 2 and hook under.

8 Form a loop in both ends to contain aluminium pulley with end nipples on outside of loops.

9 Feed pulley and wires into drive end extrusion slot centrally and refit grubscrews

10 Clip wires into all pulley grooves.

11 Roughly align gantry with mainframe extrusion

12 Move gantry to far right hand side and adjust tensioning screw until a force of 60 – 70 gms gives a wire rope deflection of 1.5mm at the centre of the free end horizontal run.

13 Visually check gantry alignment with main frame extrusion and adjust with free end extrustion grubscrews if required

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Section 2:4
Gantry assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60010/12 (A4) 60020/12 (A3)**
Exploded illus. line no: **6**
Used on models: **All**

Information contained in this section

Gantry assembly – Removal and replacement

Y axis potentiometer – Removal and replacement

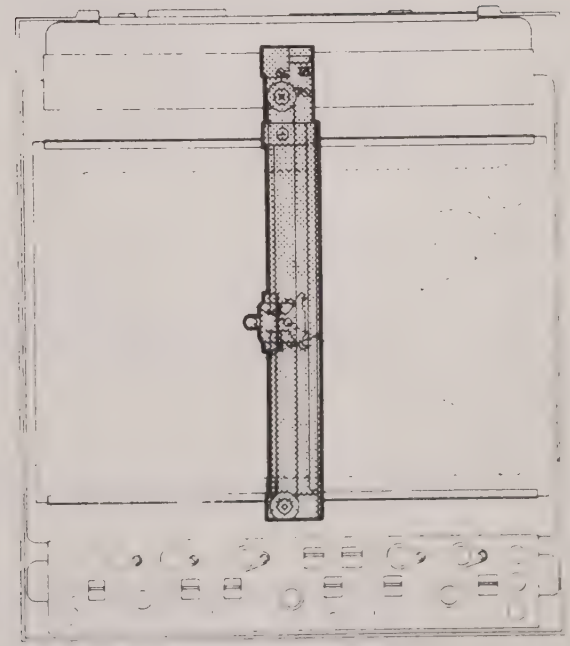
Gantry drive and free ends, pen and pen carriage and Y axis film strip are described in later sections.

Tools required for maintenance of this assembly:-

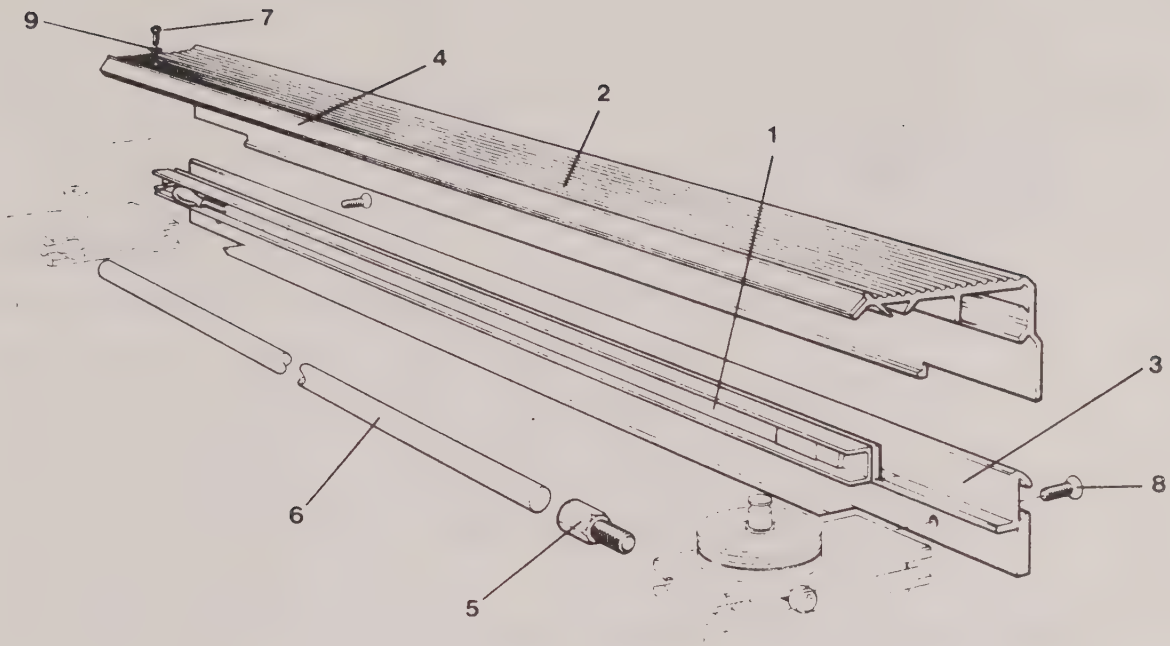
Screwdriver – Pozidriv No. 1
Screwdriver – Pozidriv No. 2

Soldering iron – Less than 30W

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty	Item	Description	Code No.	Qty
1	Potentiometer Assembly (A4)	60010/60	1	5	Guide Bar Compensator	60000/571	1
	Potentiometer Assembly (A3)	60020/60	1	6	Guide Bar (A4)	60010/504	1
2	Gantry Cover (A4)	60010/509	1		Guide Bar (A3)	60020/504	1
	Gantry Cover (A3)	60020/509	1	7	Screw M3 × 10 Pozi Pan		1
3	Gantry Rear (A4)	60010/512	1	8	Screw M3 × 10 Pozi Csk		2
	Gantry Rear (A3)	60020/512	1	9	Washer M3 Plain		1
4	Scale Bar (A4)	60010/518	1				
	Scale Bar (A3)	60020/518	1				

Removal

1 Remove main frame as described in Section 2 Sub-section 1.

2 Remove bedplate as described in Section 2, Sub-section 2.

3 Remove X axis wire rope as described in Section 2, Sub-section 3.

4 Unplug Y axis film strip from connector.

5 Remove two screws and plastic cover to release X axis flexible strip end board.

6 Unsolder five wires from X axis film strip end board taking careful note of wire colours and their positions.

7 Invert the mainframe taking care not to damage gantry.

8 Release two pozidriv screws and remove protective cover.

9 Release single pozidriv screw and remove X axis brush moulding assembly from drive end gantry extrusion and allow to hang free on connecting wire.
Note Extreme care must be exercised with this unit.

10 Remove pozidrive screw and the rubber padded end stop from left hand side of the front guide bar (grooved end).

11 Remove two screws from rear left hand end stop bracket securing the black rear guard to the rear guide bar.

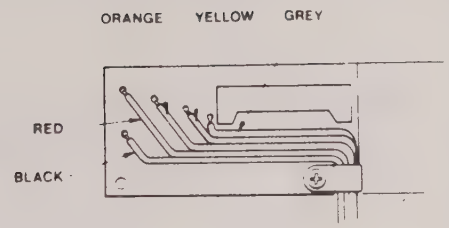
12 The gantry can now be removed from the left hand side of the recorder

Replacement

1 The gantry assembly can be refitted in reverse order to removal described above.

2 Align X axis brush moulding with edge of extrusion.

Note The inset illustration shows the wire connections to the X axis film strip end board. (See paragraph 7 above).



Removal, Replacement and adjustment of component parts

Gantry end (drive) assembly – See Section 2, Sub-section 5

Gantry end (free) assembly – See Section 2, Sub-section 6

Pen and pen carriage – See Section 4, Sub-section 7

Film Strip – See pen carriage information, Section 2, Sub-section 7

Y axis potentiometer assembly

This is not a serviceable part and therefor a replacement should be obtained prior to removal as damage is likely to occur.

Removal

1 As it is assembled with double sided adhesive tape, prize off potentiometer assembly from gantry rear taking care not to damage the extrusion.

2 Clean off any remaining adhesive tape from extrusion.

Replacement

1 Remove protective backing sheet and align pin end of potentiometer assembly with the drive end of the gantry rear extrusion and firmly fix into position.

Adjustment – None

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Section 2:5
Gantry end (drive) assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **All**

Information contained in this section

Gantry drive end assembly – Removal and replacement

Bearing mount – Removal, replacement and adjustment

Bearings – Removal and replacement

Motor mounting bracket – Removal and replacement

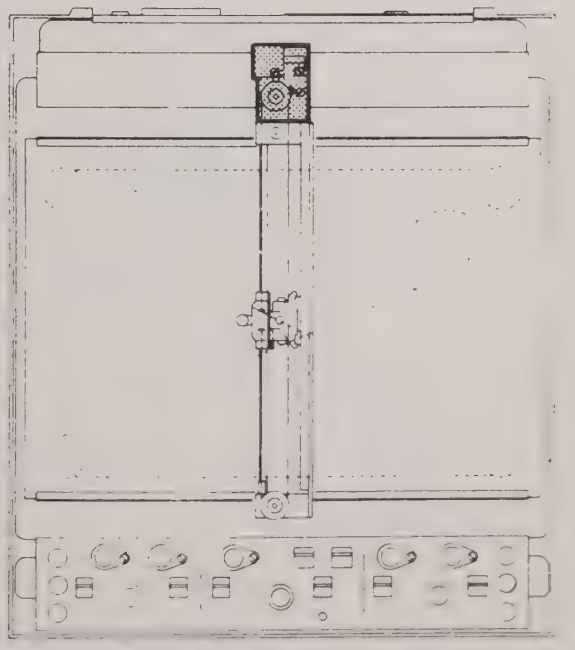
Tools required for maintenance of this assembly:-

Screwdriver – Pozidriv No. 1
Screwdriver – Pozidriv No. 2

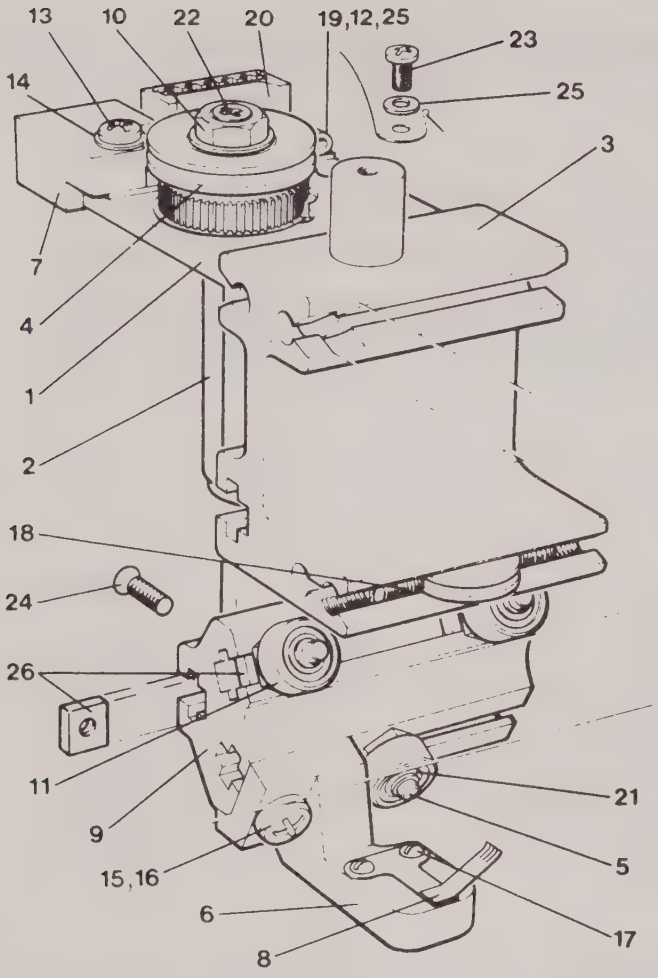
Spanner – 8 A/F open ended

Soldering iron – Less than 30W

Assembly location:-



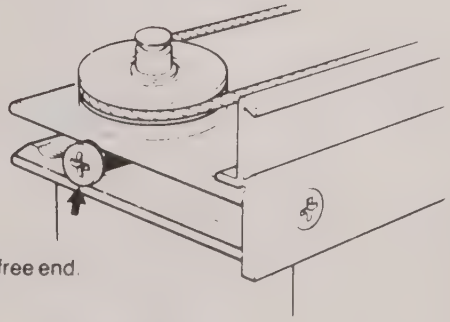
View of top of recorder with top cover and gantry cover removed.

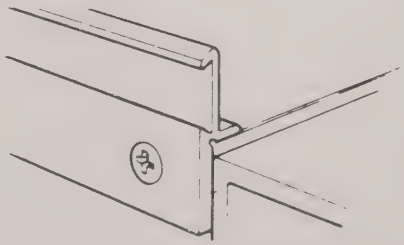


Component List

Item	Description	Code No.	Qty
1	Motor Mounting Bracket	60000/59	1
2	Servo Motor	60000/50	1
3	Gantry End	60000/58	1
4	Pulley and Gear Assy	60000/60	1
5	Carriage Bearing Spindle	60000/535	3
6	Brush Support Moulding	60000/508	1
7	Terminal Cover	60000/567	1
8	Brush Plate Assembly	60000/56	1
9	Bearing Mount	60000/545	1
10	Eccentric	50000/602	1
11	Bearing	601.105.0635	3
12	Screw M3 × 8 Pozi Pan		1
13	Screw M3 × 10 Pozi Pan		1
14	Washer M3 Plain		1
15	Screw M4 × 10		1
16	Nut M4 Square		1
17	Screw No. 2 × 3/16 Sloted Pan		2
18	Screw M5 × 10 Slotted Grub		2
19	P Clip	670.009.0006	1
20	Connector 5 Pin	421.614.7040	1
21	Circlips	719.102.0187	3
22	Screw M3 × 16 Pozi Csk.		1
23	Screw M3 × 5 Pozi Pan		1
24	Screw M4 × 8 Pozi Csk.		4
25	Washer M3 Plain		2
26	Nut M4 Square		7

Removal





1 Remove mainframe as described in Section 2, Sub-section 1.

2 Remove bedplate as described in Section 2, Sub-section 2.

3 Remove X axis wire rope as described in section 2, sub-section 3.

4 Remove gantry assembly as described in Section 2, Sub-section 4.

5 Remove one pozidriv screw on gantry cover and slide off cover towards free end.

6 Slacken wire rope tensioning screw on free end extrusion and unhook drive wire (See inset illustration).

7 Unscrew Y axis film strip earth connector. (item 23)

8 Remove drive end to gantry securing screw (See inset illustration).

9 The drive end assembly can now be removed. Care must be taken that the Y axis brush is not damaged during this operation.

Replacement

1 The gantry drive end can be replaced by reversing the removal procedure described above.

Note. When retensioning wire rope, refer to paragraph 2 on replacement, Section 2, Sub-section 8.

Removal, replacement and adjustment of component parts

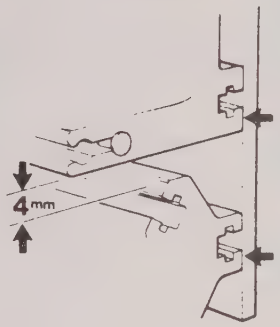
Bearing mount

Removal

1 Slacken two M4 countersunk posidriv screws on motor mounting bracket and slide bearing mount from assembly.

Replacement – This is a direct reversal of removal procedure.

Adjustment – Align edges of bearing mount and motor mounting bracket flush (See inset illustration). Adjust vertical position of bearing mount relative to drive end extrusion to give a gap of 4mm (See inset illustration).



Bearings

Removal

1 Release circlip and withdraw bearing from bearing carriage spindle.

Replacement – This is a direct reversal of removal procedure.

Note If the carriage bearing spindle is damaged, unscrew from square retaining nut and replace.

Adjustment – None.

Motor mounting bracket

Removal

1 Release two M4 countersunk posidriv screws securing motor mounting bracket to gantry drive end extrusion.

Replacement – This is a direct reversal of removal procedure.

Adjustment – None.

Servo motor – See Y axis servo motor assembly Section 2, Sub-section 9.

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Section 2:6 Gantry end (free) assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **All**

Information contained in this section

Gantry free end assembly – Removal and replacement

Bearing mount – Removal, replacement and adjustment

Bearings – Removal and replacement

Gantry compensator spring – Removal, replacement and adjustment

Pulley – Removal and replacement

Pulley spindle – Removal and replacement

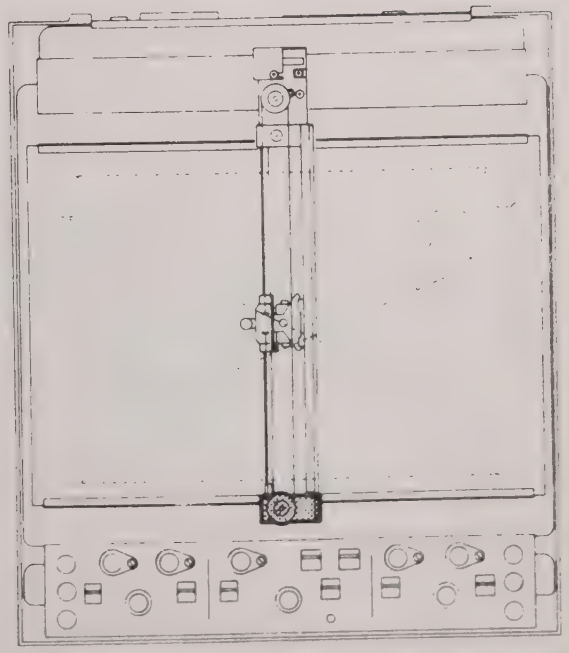
Tools required for maintenance of this assembly:-

Screwdriver – Pozidriv No. 1
Screwdriver – Pozidriv No. 2

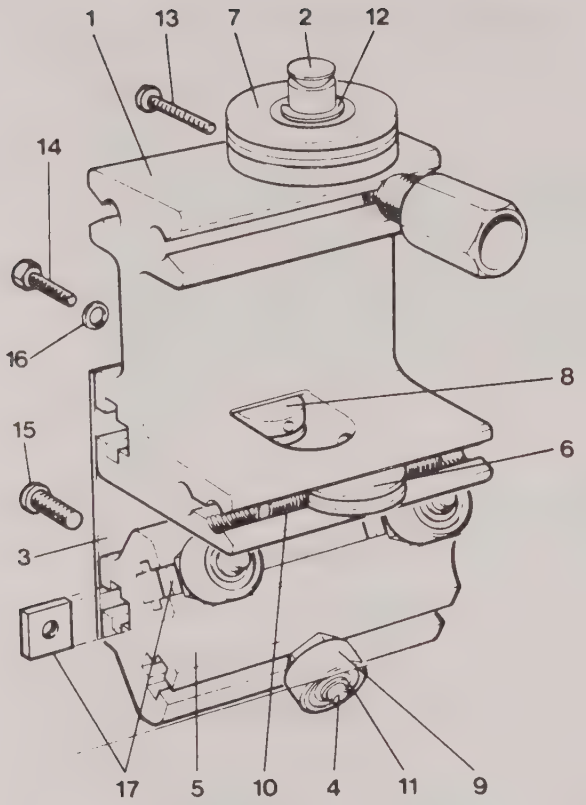
Spanner – 8 A/F open ended

Pliers – Taper nosed

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty
1	Gantry End	60000/558	1
2	Pulley Spindle	600000/530	1
3	Gantry Compensator Spring	60000/529	1
4	Carriage Bearing Spindle	60000/535	3
5	Bearing Mount	60000/545	1
6	Adjusting Pulley	60000/536	2
7	Free Pulley Moulding Assy	50000/58	1
8	Tensioner Nut	50000/515	1
9	Bearing	601.105.0635	3
10	Screw M5 × 10 Slotted Grub		2
11	Circlips	719.102.0187	3
12	Circlips	719.105.0013	1
13	Screw M3 × 16 Pozi Pan		1
14	Screw M3 × 16 Hex.		1
15	Screw M4 × 6 Pozi Pan		4
16	Washer M3 Plain		1
17	Nut M4 Square		7

Removal

1 Remove mainframe as described in Section 2 Sub-section 1.

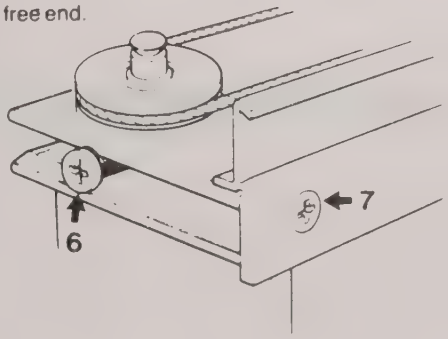
2 Remove bedplate as described in Section 2, Sub-section 2.

3 Remove X axis wire rope as described in Section 2, Sub-section 3.

4 Remove gantry assembly as described in Section 2 Sub-section 4.

5 Remove one pozidriv screw on gantry cover and slide off cover towards free end.

6 Slacken wire rope tensioning screw on free end extrusion and unhook drive wire (See inset illustration).



7 Remove free end to gantry securing screw (See inset illustration).

8 The free end assembly can now be removed. Care must be taken that the Y axis brush is not damaged during this operation.

Replacement

1 The gantry free end can be replaced by reversing the removal procedure described above

Note When retensioning wire rope, refer to paragraph 2 on replacement, Section 2, Sub-section 8

Removal, replacement and adjustment of component parts

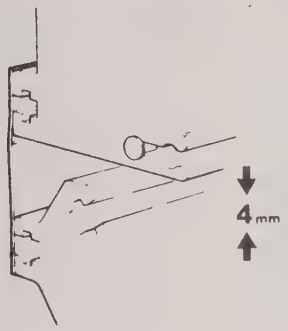
Bearing mount

Removal

1 Slacken two M4 countersunk pozidriv screws on gantry compensator spring and slide bearing mount from assembly

Replacement – This is a direct reversal of removal procedure.

Adjustment – Align edges of bearing mount and gantry compensator spring flush (see insert illustration). Adjust vertical position of bearing mount relative to the free end extrusion to give a gap of 4 mm (See inset illustration)



Bearings

Removal

1 Release circlip and withdraw bearing from bearing carriage spindle.

Replacement – This is a direct reversal of removal procedure.

Note. If the carriage bearing spindle is damaged, unscrew from square retaining nut and replace.

Adjustment – None.

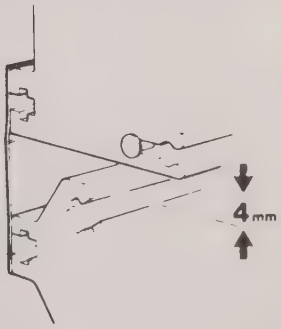
Gantry compensator spring

Removal

1 Release totally the wire rope adjuster, slacken two pan head pozidriv screws and slide spring from free end extrusion.

Replacement – This is a direct reversal of removal procedure.

Adjustment – Align edge of compensator spring and free end extrusion flush (See inset illustration). Adjust vertical position of assembly relative to the free end extrusion to give a gap of 4 mm (See inset illustration).



Pulley

Removal

1 Release circlip and withdraw pulley from pulley spindle.

Replacement – This is a direct reversal of removal procedure.

Adjustment – None

Pulley spindle

Removal

1 Completely remove the M3 pan head pozidriv screw (Y axis wire rope adjuster) and withdraw the pulley and spindle assembly

2 Remove pulley as described above

Replacement – This is a direct reversal of removal procedure

Adjustment - None

Guide bar compensator

[illegible] is thread locked at the factory and should not be removed or adjusted

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Section 2:7
Pen and pen carriage

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60000/10**
Exploded illus. line no:
Used on models: **All**

Information contained in this section

Pen and pen carriage assembly – Removal and replacement

Bearings – Removal and replacement

Solenoid – Removal and replacement

Brush assembly – Removal and replacement

Pen holder – Removal and replacement

Pen pressure adjuster – Removal, replacement and adjustment

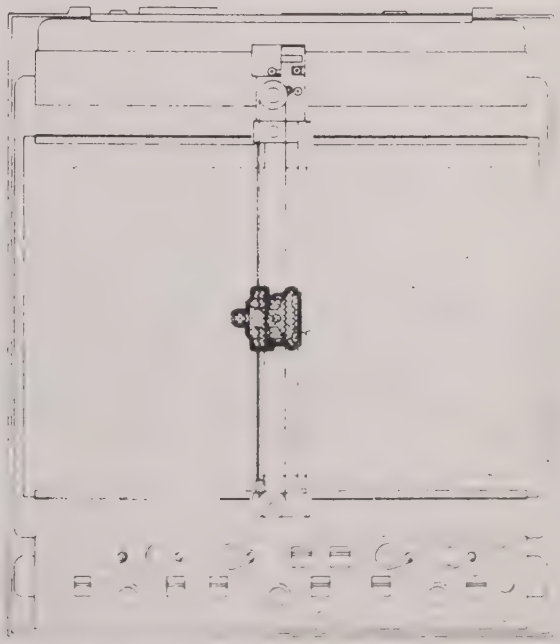
Tools required for maintenance of this assembly:-

Screwdriver – Pozidriv No. 1
Screwdriver – Suitable for M3 screws

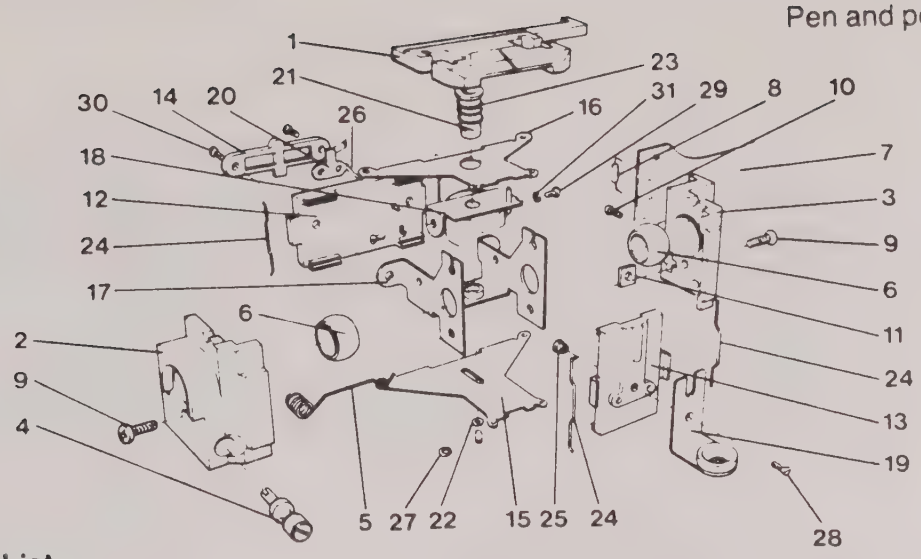
Pliers – Taper nosed

Soldering iron – Less than 30W

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty	Item	Description	Code No.	Qty
1	Top Moulding	60000/512	1	16	Pen Arm (Top)	60000/551	1
2	Left Hand Moulding	60000/513	1	17	Solenoid Frame Sub-Assy	60000/54	1
3	Right Hand Moulding	60000/514	1	18	Solenoid Top Plae Assy	60000/53	1
4	Pen Pressure Adjuster	60000/517	1	19	Pen Holder Assembly	60000/55	1
5	Pen Pressure Spring	60000/519	1	20	Brush Plate Assembly	60000/56	1
6	Bearing	60000/520	2	21	Solenoid Plunger Assembly	60000/57	1
7	Y Axis Film Wire	60000/576	1	22	Shim Washer	60000/597	1
8	Diode IN4148	337.004.0017	1	23	Plunger Spring	60000/521	1
9	Screw M3 × 10 Pozi Pan		2	24	Retainer Spring	60000/528	4
10	Screw M2.5 × 5 Pozi Pan		1	25	Insert	699.099.0068	1
11	Nut M2.5 Square		1	26	Wire – Black × 60mm	450 101 0736	1
12	Rear Moulding	60000/505	1	27	Circlip DIN 1500-56 1.5	719 105.0017	1
13	Pen Holder Moulding	60000/506	1	28	Screw M2 × 4 Slotted Csk		1
14	Rear Bearing and Brush Retainer Moulding	60000/507	1	29	Screw M3 × 5 Pozi Pan		2
15	Pen Arm (Bottom)	60000/550	1	30	Screw M3 × 8 Pozi Pan		2
				31	Washer M3 Single Coil		2

Removal

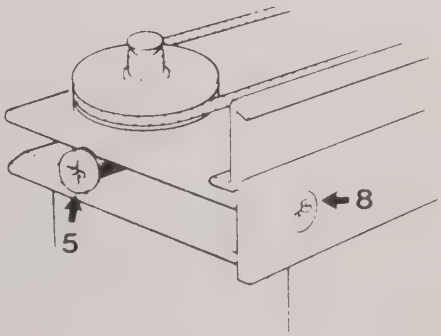
1 Remove mainframe as described in Section 2. Sub-section 1.

2 Remove screw securing cover to gantry.

3 Align gantry cover with slot on finger guard.

4 Slide gantry cover towards free end and remove carefully.

5 Slacken wire rope tensioning screw on free end extrusion (see insert illustration) and unhook drive wire from pulley and pen carriage wire locating slots.



6 Unplug Y axis film strip from socket and remove earthing screw

7 Carefully peel back Y axis film strip from gantry rear panel extrusion, noting folds on A4 model and position of adhesive areas and feed free end through slot

8 Remove gantry free end to back panel securing screw (See inset diagram)

9 The free end extrusion can now be pulled back sufficiently to remove the guide bar and pen carriage complete

Note: Extreme care must be taken not to damage the potentiometer brush and the hexagonal guide bar adjusting nut must not be moved as this is a factory set tolerance

10 The pen carriage can now be removed from the guide bar

Replacement

1 Slide the pen carriage on to the Y axis guide bar.

2 With the pen holder on the opposite side of the guide bar to the gantry rear extrusion, refit the guide bar into the locating hole in the drive end extrusion.

3 Pull back the free end extrusion sufficiently to engage the other end of the guide bar into the hexagonal guide bar adjusting nut. **Note:** this nut must not be moved as it is a factory set tolerance.

4 Make sure that the Y axis potentiometer brushes are correctly located then refit free end extrusion to gantry back panel.

5 Carefully feed Y axis film strip through slot in gantry back panel and secure with double sided tape to areas noted when removing. On A4 models the strip must be folded as before.

6 Reconnect Y axis film strip to socket and replace earth screw.

7 The remaining replacement procedure is a direct reversal of removal paragraphs 1 – 5.

Note: When retensioning wire rope, refer to paragraph 2 on replacement, Section 2, Sub-section 8.

Removal, replacement and adjustment of component parts

Bearings

Removal

1 Lift off top moulding.

2 Release one M3 pan head pozidriv screw on either side of carriage and remove left and right hand mouldings.

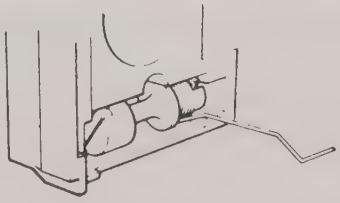
3 The bearings can now be removed.

Replacement

Note. It is advisable to fit new bearings at this stage

1 Press bearings into socket, replace end and top mouldings

Note. Care must be taken to ensure correct positioning of pen pressure spring located in the left hand moulding – See details of this assembly below.



Adjustment – None.

Solenoid

Removal

1 Lift off top moulding.

2 Release one M3 pan head pozidriv screw on either side of carriage and remove left and right hand mouldings.

3 Release one M2.5 slotted pan head screw securing Y axis film wire to end moulding

4 Unsolder wires noting positions for reassembly.

5 Remove circlip from solenoid plunger and remove spring and plunger complete

6 Carefully unhook retaining springs from pen holder moulding and rear moulding by sliding the retaining springs up or down

7 The pen holder moulding and top and bottom pen arms are now free

8 Unscrew two M3 pozidriv pan head screws and remove solenoid top plate

9 The solenoid can now be removed

Solenoid – Continued

Replacement – This is a direct reversal of removal procedure.

Note. A small screwdriver is useful for relocating retaining springs.

Adjustment – None.

Brush assembly

Removal

1 Release two M3 pozidriv pan head screws and remove rear bearing/brush retainer moulding.

2 Unsolder wire and remove brush plate assembly.

Replacement – This is a direct reversal of removal procedure.

Adjustment – None.

Pen holder

Removal/Replacement

1 To remove and replace pen holder assembly, release the M2 countersunk slot head screw.

Adjustment – None

Pen pressure adjuster

Removal

1 Remove top moulding.

2 Release M3 pozidriv pan head screw and remove right hand moulding.

3 Lift out adjuster and spring complete.

Replacement

1 Insert adjuster and spring into slot in right hand end moulding.

2 Carefully position spring on bottom pen arm, replace end moulding and secure with screw.

Adjustment – By turning clockwise to increase or anticlockwise to decrease spring pressure, adjust until a lift of 10 gms at the pen is achieved with the pen solenoid energised.

Note. On no account should the adjusting screw be rotated more than ½ turn in either direction.

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Section 2:8
Y axis wire rope

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60010/63 (A4) 60020/63 (A3)**
Exploded illus. line no:
Used on models: **All**

Information contained in this section

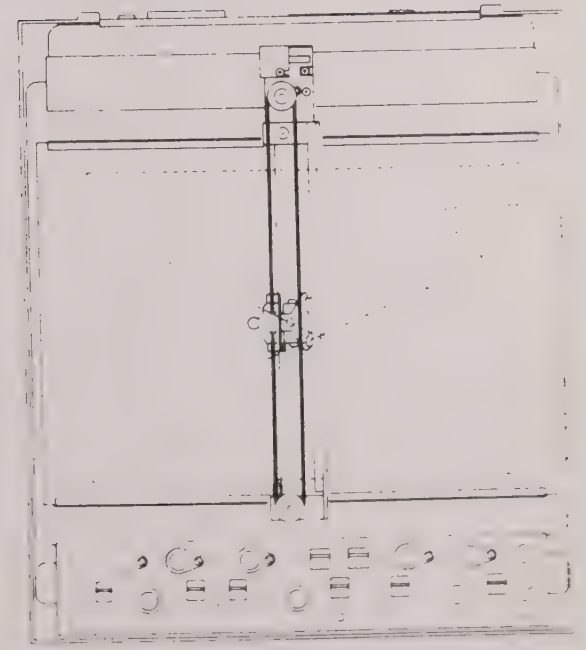
Wire rope assembly – Removal and replacement

Tools required for maintenance of this assembly:-

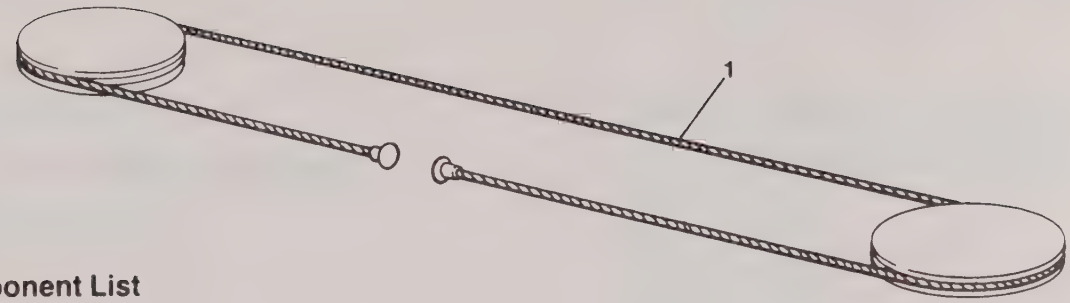
Screwdriver – Pozidriv No. 1

Gram Gauge – 0-100 gms

Assembly location:-



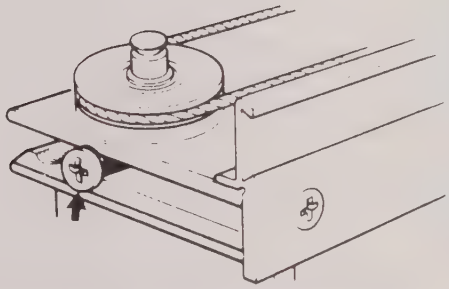
View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty
1	Y Axis Wire Rope Assembly		
	(A4)	60010/63	1
	(A3)	60020/63	1

Removal



1 Remove mainframe as described in Section 2, Sub-section 1.

2 Remove screw securing cover to gantry.

3 Align gantry cover with slot on finger guard.

4 Slide gantry cover towards free end and remove completely.

5 Slacken wire rope tensioning screw on free end extrusion (See inset illustration) and unhook drive wire from pulley and pen carriage wire locating slots.

Replacement

1 Refit wire rope into pen carriage locating slots and around free end and drive end pulleys.

2 Adjust the wire rope tensioning screw until a force of 35 gms applied at right angles to the wire in the mid position of the rear run gives a deflection of 1.5mm.

3 Continue with a reversal of removal procedures 1 – 4 above.

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Section 2:9
Y axis servo motor assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **All**

Information contained in this section

Y axis servo motor assembly – Removal and replacement

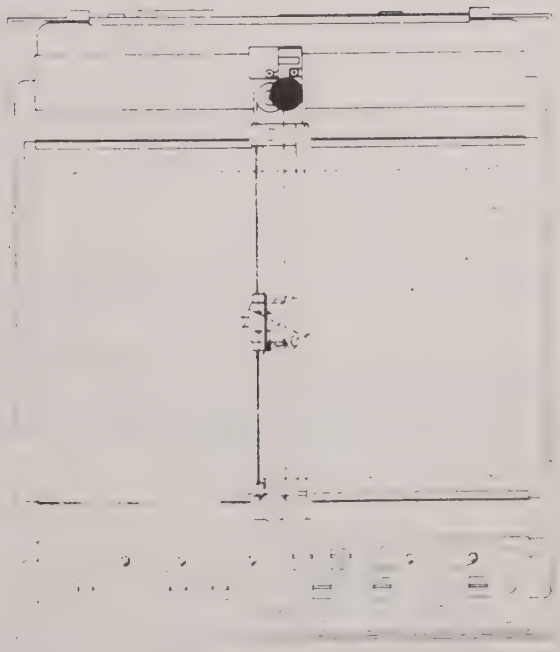
Tools required for maintenance of this assembly:-

Screwdriver – Pozidriv No. 1
– Small, suitable for slotted screws

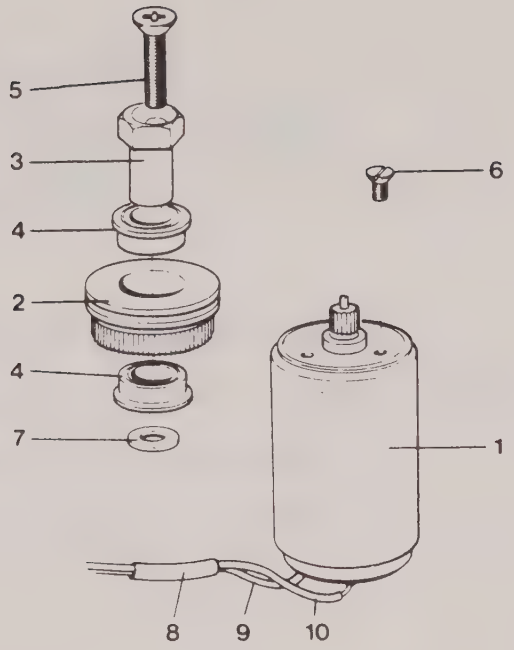
Spanner – 8mm A/F open ended
– 5.5mm A/F open ended

Soldering iron – Less than 30w

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty
1	Servo Motor	60000 50	1
2	Pulley and Gear Assembly	60000 60	1
3	Eccentric	50000 602	1
4	Bearings	601.105.0637	2
5	Screw M3 × 16 Pozi Csk.		1
6	Screw M2 × 3 Csk.		3
7	Washer M3 Plain		1
8	Sleeve H15 × 20		1
9	Wire – Red	450.103.0736	A/R
10	Wire – Orange	450.105 0736	A/R

Removal

1 Remove mainframe as described in Section 2. Sub-section 1.

2 Remove Y axis wire rope as described in Section 2, Sub-section 8.

3 Unplug Y axis film strip.

4 Release two pozidriv screws and remove protective cover and 'P' clip to release X axis film strip end board

5 Unsolder servo motor wires (red and orange) noting their positions.

6 Release pozidriv countersunk screw on pulley and gear assembly and remove.

7 Release three countersunk slot head screws and remove motor. Store these screws carefully as their lengths are critical and they should be used on reassembly.

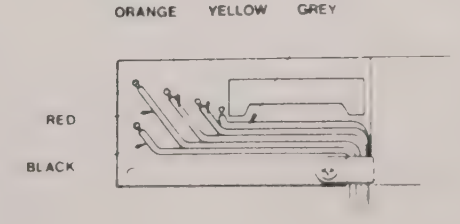
Replacement

1 Place motor in position and secure with the three M2 × 4mm long countersunk screws – It is important to use the correct screws to prevent damage to the motor.

2 Refit the wire rope pulley and gear assembly but do not tighten the securing screw.

3 Rotate the eccentric until the gears are satisfactorily in mesh and there is minimum backlash Ensure that the gear/motor assembly runs freely – if the mesh is too tight it could cause damage. Excessive backlash will cause servo oscillation. Tighten the securing screw whilst holding the eccentric still

4 Reconnect the servo motor wires to the X axis film strip end board. (See inset illustration)



5 Refit wire rope and retension as described in Section 2, Sub-section 8.

6 Refit mainframe as described in Section 1. Sub-section 1.

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Section 2:10
X axis servo motor assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **All**

Information contained in this section

X axis servo motor assembly – Removal and replacement

Bearings – Removal and replacement

Wire scroll – Removal and replacement

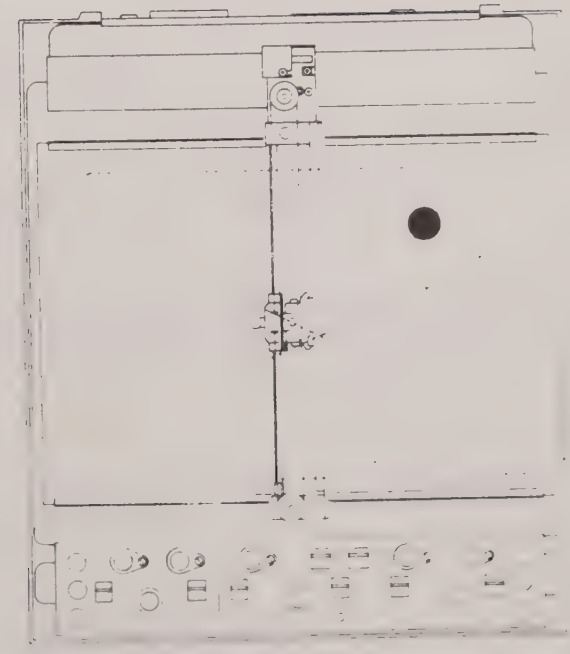
Tools required for maintenance of this assembly:-

Screwdriver – Small, suitable for slotted screws

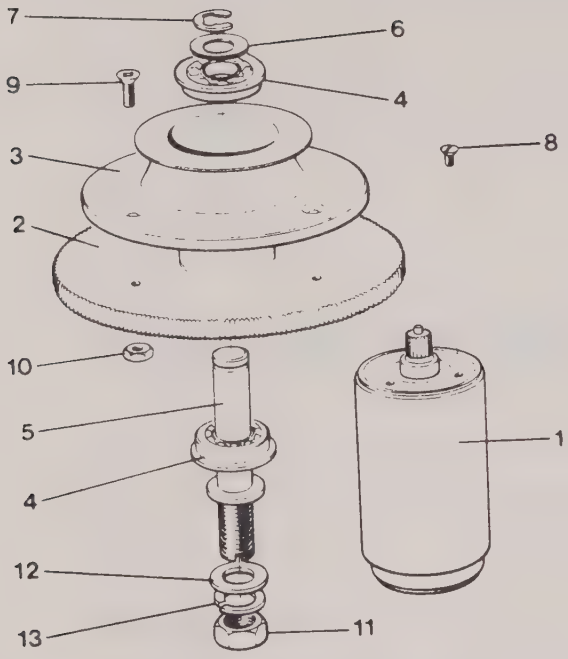
Spanner – 5.5mm A/F open ended

Soldering irong – Less than 30w

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

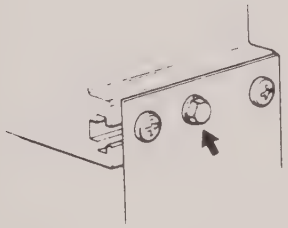
Item	Description	Code No.	Qty
1	Servo Motor	60000 50	1
2	Drive Gear	60000 554	1
3	Drive Pulley	60000 532	1
4	Bearings	601.105 0001	2
5	Drive Spindle	60000 553	1
6	CB Disc Spring	719 105 0001	1
7	Circlip DIN 1500		3
8	Screws M2 × 3 Csk		3
9	Screws M3 × 8 Pozi Csk.		3
10	Nut M3 Hex		3
11	Nut M6 Hex		1
12	Washer M6 Plain		1
13	Washer M6 Single Coil		1

Removal

1 Remove mainframe as described in Section 2, Sub-section 1.

2 Remove bedplate as described in Section 2, Sub-section 2.

3 Slacken X axis wire rope tensioning screw located on the gantry free end. (See inset illustration).



4 Slacken grubscrews on free end drive and hook wires under each pulley.

5 Remove wire loop from scroll.

6 Remove circlip and withdraw gear and drive pulley assembly from spindle.

7 Remove two M4 screws and protective cover from mainframe.

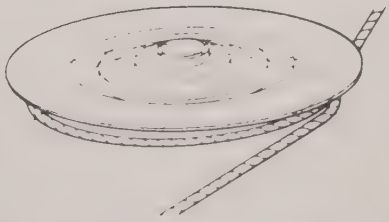
8 Unsolder film wire from motor.

9 Release three countersunk slot head screws and remove motor. Store these screws carefully as their lengths are critical and they should be used on reassembly.

Replacement

1 Place motor in position, ensuring that the positive pole on both the motor and the film strip correspond than secure with the three M2 × 4mm long countersunk screws – It is important to use the correct screws to prevent damage to the motor.

2 Re-solder motor connections.



3 Refit gear and drive pulley assembly

4 Form a loop in the wire rope fit over drive pulley so that the wire to pulley 3 is above the diagonally run wire from pulley 1. (See inset illustration and page 2:3:2 for pulley identification).

5 Retension wire rope as described in Section 2, Sub-section 3.

6 If the gears require re-alignment, remove protective cover by releasing two M4 pan head screws to gain access to the eccentric adjuster and refer to paragraph under 'Removal, replacement and adjustment'

7 Refit protective cover to mainframe and secure with two M4 screws

8 Replace bedplate and mainframe.

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Removal, replacement and adjustment of component parts

Bearings

Removal/Replacement – On removal of the gear and drive pulley assembly, the top and bottom bearings can be lifted out and refitted the same way.

Adjustment – None

Wire scroll

Removal

1 Release three M3 countersunk pozidriv screws by holding the corresponding nut with a suitable spanner (These will be tight as they are thread locked on assembly).

2 Lift off drive pulley.

Replacement – This is a direct reversal of removal procedure.

Note. Use a suitable thread locking liquid on reassembly.

Adjustment – None.

Gear mesh adjustment

1 Rotate the eccentric until the gears are satisfactorily in mesh and there is minimum backlash. Ensure that the gear/motor assembly runs freely – if the mesh is too tight it could cause damage. Excessive backlash will cause servo oscillation. Tighten the securing screw.

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Section 2 : 11
Front panel assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60120/1 & 60000/1**
Exploded illus. line no: **1**
Used on models: **Multi Range and Systems**

Information contained in this section

Front panel assembly – Removal and replacement

Front screen – Removal and replacement

Component board (PCB) – Removal and replacement

LED indicator – Removal and replacement

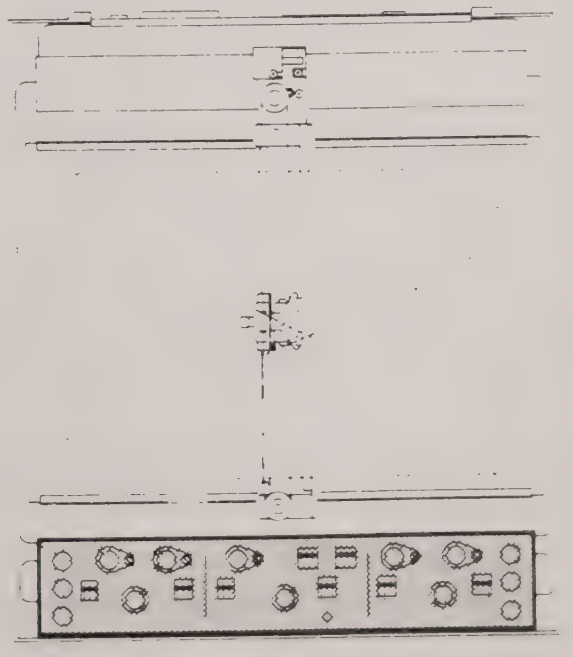
Tools required for maintenance of this assembly:-

Screwdriver – Pozidriv No. 1
– Suitable for M3 slotted screws

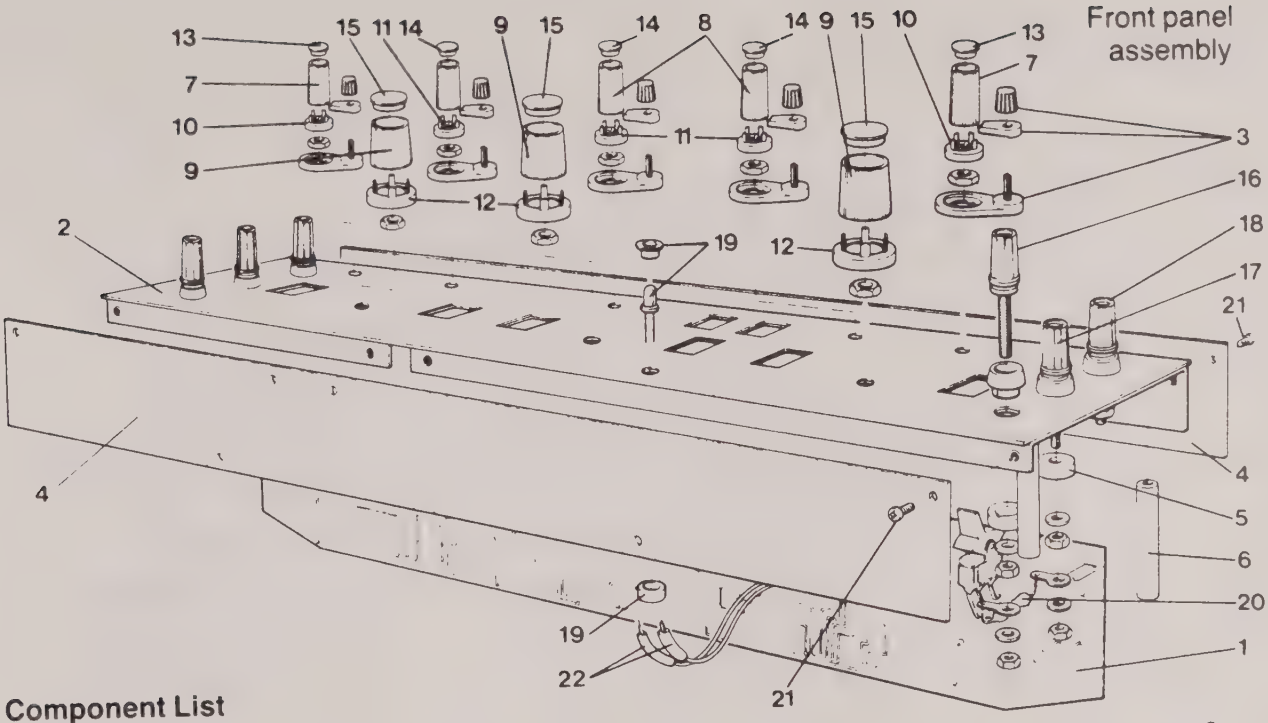
Pliers – Taper nosed

Soldering iron – Less than 30w

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty	Item	Description	Code No.	Qty
1	Front Panel PCB Assy	60000/12	1	12	Nut Cover	732.004.0024	3
2	Front Panel Assembly	60000/64	1	13	Knob Cap	732.004.0033	2
3	Locking Knob Assembly	60000/51	5	14	Knob Cap	732.004.0027	3
4	Screen Plate	60000/562	2	15	Knob Cap	732.004.0026	3
5	Earth Connector	60000/565	2	16	Terminal Post	430.200.016	2
6	Nylon Pillar	750.008.0256	4	17	Terminal Post	430.200.015	2
7	Knob	732.004.0030	2	18	Terminal Post	430.200.014	2
8	Knob	732.004.0023	3	19	LED and Clip	336.004.0010	1
9	Knob	732.004.0022	3	20	Capacitor	313.100.6330	2
10	Nut Cover	732.004.0031	2	21	Screw M3 × 6 Pozi Pan		8
11	Nut Cover	732.004.0025	3	22	Sleeve H15 × 20		2

Removal

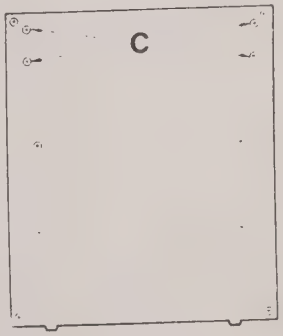
1 Remove mainframe as described in Section 2, Sub-section 1.

2 Release four M3 screws ('C') securing front panel to base moulding whilst supporting front panel assembly. (See inset illustration).

3 Remove four M3 screws securing rear screening plate on front panel assembly.

4 Unplug three film strips from sockets.

5 Unplug connector leads from either end of front panel PCB noting their respective positions for reassembly.



Replacement

1 Replacement is a direct reversal of removal procedure.

Removal, replacement and adjustment of component parts

Front screen

Removal

1 Release four M3 pozidriv pan head screws and remove screen

Replacement – This is a direct reversal of removal procedure

Adjustment – None

Component board (PCB)

Removal

1 Unsolder wires from input socket tabs to PCB taking careful note of wire positions.

2 Unsolder two wires from LED indicator to PCB. **Note** it is recommended that one of these wires is marked to aid reassembly

3 Unscrew and remove potentiometer locking parts

4 Lift off top caps of control knobs.

5 Release collet locking screws and remove knobs.

6 Remove M3 pozidriv pan head screw securing PCB to pillar (Systems recorders only).

7 Release potentiometer and switch retaining nuts and remove PCB.

Replacement – This is a direct reversal of removal procedure.

Adjustment – None

L.E.D. indicator

Removal

1 Unsolder two wires from LED to PCB **Note** It is recommended that one of these wires is marked to aid reassembly

2 Release locking collar and remove LED.

Replacement – This is a direct reversal of removal procedure.

Note It may be necessary to fit a new LED retaining kit.

Adjustment – None.

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Section 2 : 12
Rear panel assembly

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60000/14**
Exploded illus. line no: **9**
Used on models: **Multi Range and Systems**

Information contained in this section

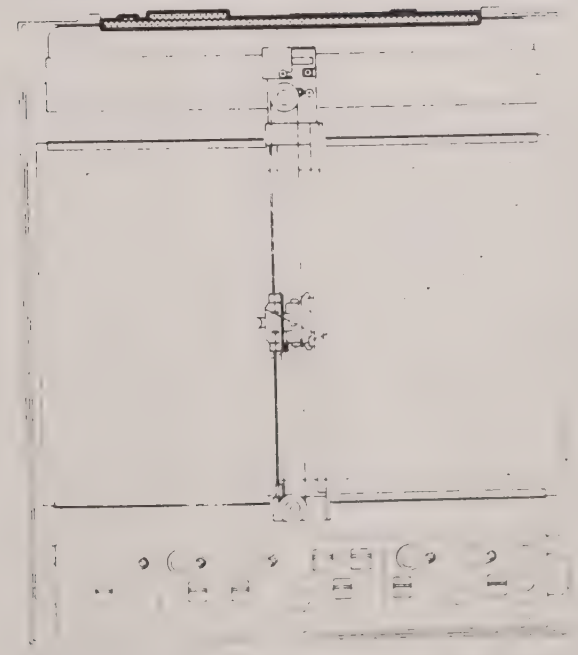
Rear panel assembly – Removal and replacement

Tools required for maintenance of this assembly:-

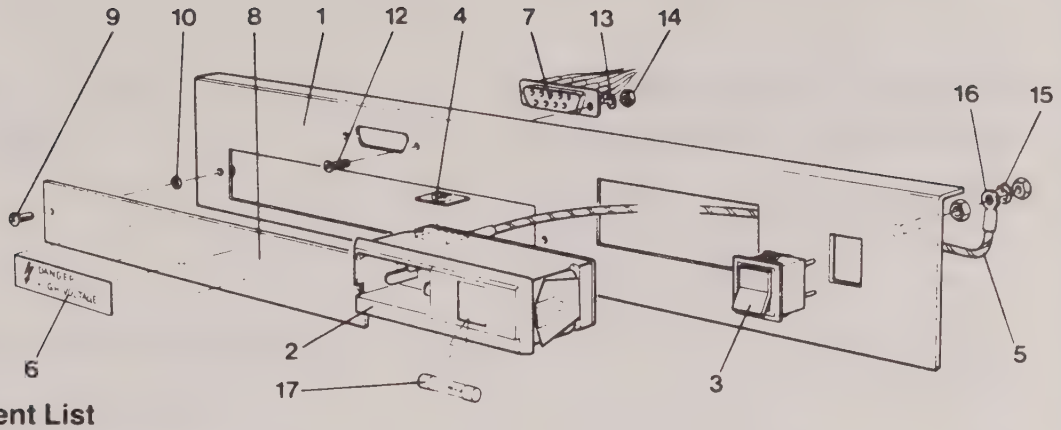
Screwdriver – Small, suitable for slotted screws

Spanner – 8mm A/F open ended

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty	Item	Description	Code No.	Qty
1	Back Panel	60000/582	1	9	Captive Screw 10mm Lg.	60000/600	2
2	Mains Input Module	421.404 6032	1	10	Circlip DIN 1500	719.105.0010	2
3	Mains Switch	355 019 0042	1	11	Screw M3 × 6 Pozi Pan	–	2
4	Protective Earth Label	60000/580	1	12	Nut M3 Hex	–	2
5	Earth Wire	450.000.0010	A/R	13	Washer M3 Single Coil	–	2
6	Warning Label	60000/581	1	14	Nut M4 Hex	–	1
7	Input Harness Assembly (A4)	60010/13	1	15	Washer M4 Single Coil	–	1
	Input Harness Assembly (A3)	60020/13	1	16	M4 Solder Tag	–	2
8	Blanking Plate	60100/504	1	17	Fuse 1¼" Cartridge 500MA	352 500.0101	1

Removal

1 Remove mainframe as described in Section 2, Sub-section 1.

2 Lift out panel complete.

Note: If panel is to be disconnected from the recorder completely, the following procedure should be followed.

3 Disconnect harness from terminal block noting position of each wire for reconnection. (They should be same colour code as the wires on the opposite side of the terminal block).

4 Disconnect earth lead from rear panel.

5 Release front panel as described in Section 2, Sub-section 11 to allow removal of connecting leads

6 The rear panel is now completely disconnected.

Replacement

1 Replacement is a direct reversal of removal procedure.

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Section 2 : 13
Main PCB

Series 60000 X Y recorder maintenance instructions.

Assembly code: **60020/2 60120/2 60121/2**
Exploded illus. line no: **7**
Used on models: **All**

Information contained in this section

Main PCB – Removal and replacement

Transformer – Removal and replacement

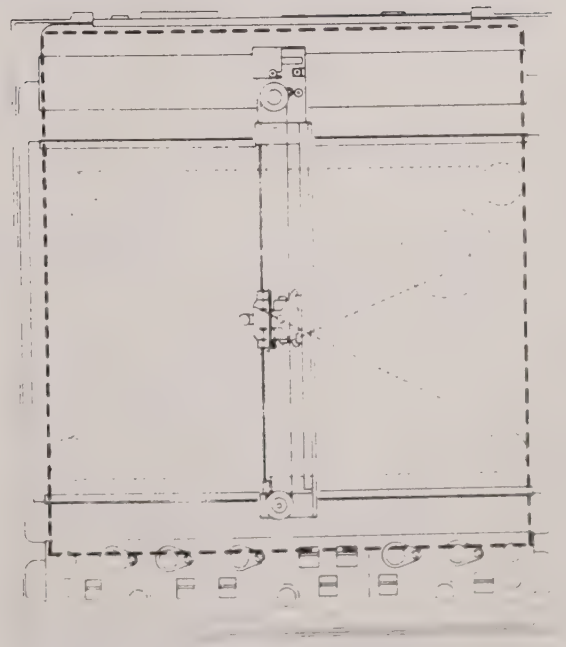
Tools required for maintenance of this assembly:-

Screwdriver – Pozidriv No. 1
– Small, suitable for slotted screws

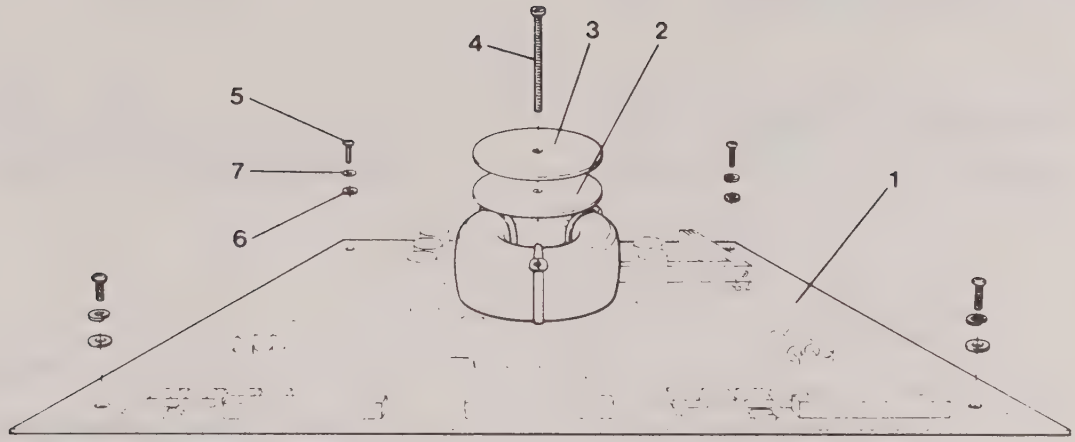
Side Cutters

Soldering iron – Less than 30w

Assembly location:-



View of top of recorder with top cover and gantry cover removed.



Component List

Item	Description	Code No.	Qty	Item	Description	Code No.	Qty
1	Main PCB (Multi Range)	60020/2	1	4	Screw M4 × 30 Pozi Pan		1
	Main PCB (Systems)	60120/2	1	5	Screw M3 × 6 Pozi Pan		4
2	Transformer Packing Ring	60000/542	1	6	Washer M3 Plain		4
3	Transformer Clamp Plate	60000/543	1	7	Washer M3 Single Coil		4

Removal

1 Remove mainframe as described in Section 2, Sub-section 1.

2 Remove front panel as described in Section 2, Sub-section 11.

3 Lift out rear panel and disconnect harness from terminal block noting wire coding to enable reconnection.

4 Remove screw securing transformer to base moulding.

5 Remove four M3 screws securing PCB to base moulding and lift out.

Replacement

1 Replacement is a direct reversal of removal procedure.

Removal, replacement and adjustment of component parts

Transformer

Removal Note Do not remove unless new securing ties are available for reassembly.

1 Cut ties securing transformer to PCB.

2 Release five wires from terminal block making a note of wire colour and positions.

3 Pull back sleeving and unsolder nine wires from terminal pins making a note of wire colours and positions

4 Cut ties and remove transformer

Replacement – Resecure transformer with new ties and reverse the removal procedure

Adjustment – None

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Section 3:1
A3 and A4 Multi Range

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no: 7
Used on models: **Multi Range**

Information contained in this section

Circuit diagrams and component lists for all electronics relevant to the 60000 A3 and A4 Multi Range unit.

General information

Power Supply

A toroidal mains transformer is used with three separate secondary windings each having an integrated bridge rectifier and either one or two integrated regenerators associated with it. Ten voltage levels are generated, referred to three ground levels. X axis amplifiers and timebase use ±16v unregulated and ± 12v regulated supplies referred to 0v X. Y axis amplifiers use ±16v unregulated and ± 12v regulated supplies referred to 0v Y. The control and drive circuitry for electrostatic hold-down, pen solenoid and logic and switching functions use +25v unregulated and +5v regulated supplies.

X and Y signal and servo amplifiers

Input signals to the recorder are attenuated by the sensitivity control circuitry on the instrument front panel, this attenuated signal is applied to the signal amplifiers on the main p.c.b.

The first of these is a pre-amp, op-amp combination, the gain of which is set by the sensitivity controls on the front panel. The second stage of amplification incorporates an active notch filter at the line frequency. At the next stage, offset, variable sensitivity, external offset and variable timebase (X only) are summed with the input signal – and the electronic limit control signal is applied.

The output from this stage is then summed with the position feedback signal at the input of the servo amplifier. This final stage consists of two power op-amps connected in a bridge circuit supplying drive to the servo motors which move the gantry and pen carriage.

Timebase

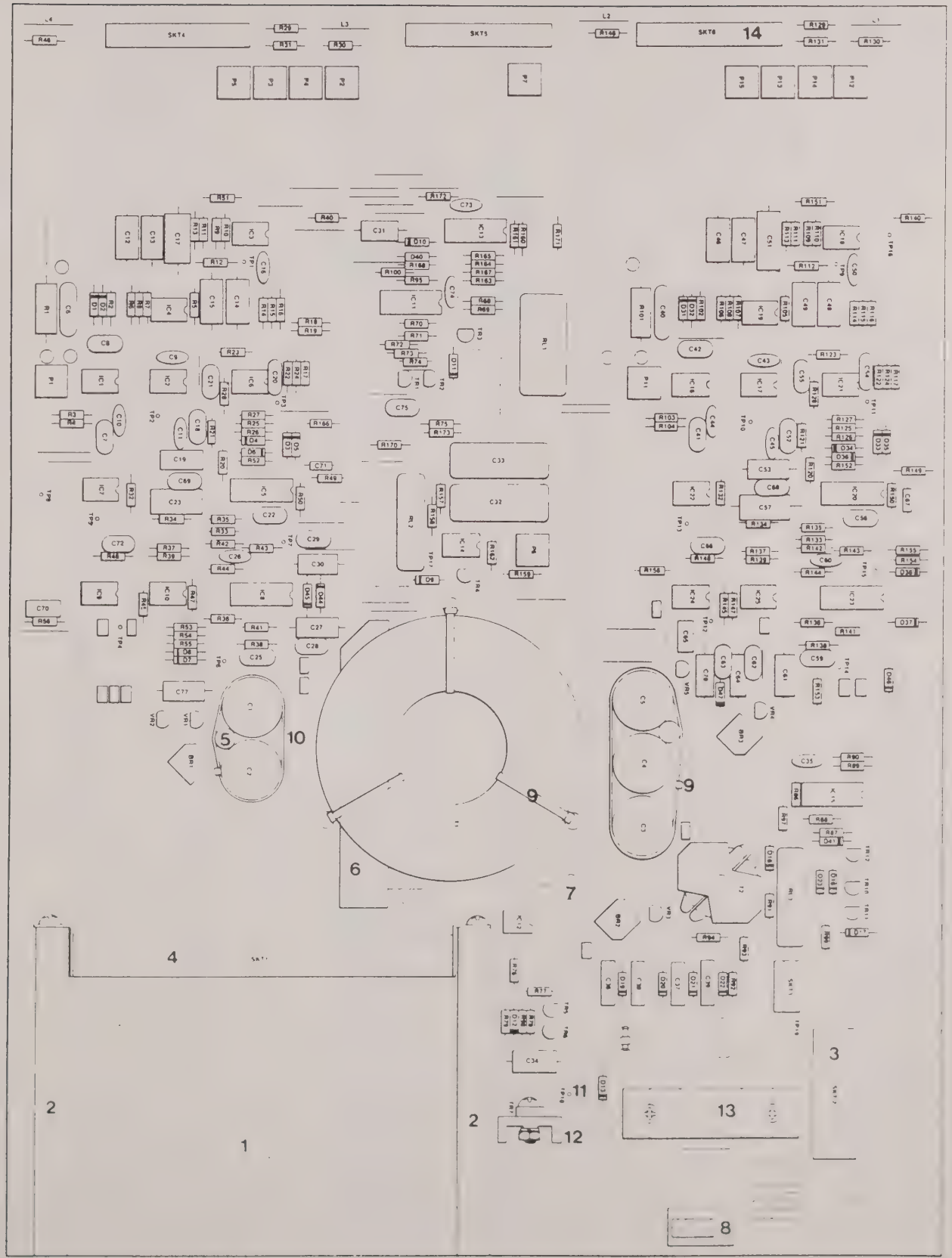
An integrator is used to generate a linear ramp which is fed into the third stage of the X amplifier chain. Input current to the integrator is controlled over two decades by the s/cm switch on the front panel. The front panel variable control reduces the feedrate selected by attenuating the signal fed to the X amplifier chain.

Controls etc.

Eht for electrostatic hold-down is provided by an oscillator driving a step-up transformer into a voltage quadrupler The resulting output of approx. 1Kv is applied to the bed-plate.

The pen is controlled by the timebase circuit and the front panel switch, the control signal being opto-coupled to the earth referenced drive circuit The pen down command initially applies a high voltage to the pen solenoid this voltage decaying to a lower, holding level.

Main PCB – Multi Range



Component	Description	Code No.	Qty
1	Main PCB	60000/502	1
2	Personality PCB Guide	60000/544	2
3	Film Wire Connector	60000/69	1
4	Personality Module Connector	60000/587	1
T1	Power Supply Transformer	60000/560	1
T2	Paper Hold Transformer	50000/57	1
5	Capacitor Support	60000/584	2
6	Scotch Electrical Tape	485.002.0317	A/R
7	Ty-Rap Ty23M	718.700.1001	14
–	Screw M3 × 6 Pozi Pan	–	6
–	Nut M3 Square	–	4
–	Screw M3 × 6 Pozi Pan Taptite	–	2
–	Screw M3 × 20 Pozi Pan	–	2
8	Cable Clip	718 100.0119	1
9	Ty-Rap Ty 525M	718.700.1004	4
10	Ty-Rap Ty 24M	718.700.1002	1
11	PCB Pins	713.005.0005	28
Skt 3	4 Way Connector	421.614.7041	1
12	Heatsink	415.100.0003	1
–	Screw M3 × 10 Pozi Pan	–	1
–	Nut M3 Hex	–	3
–	Washer M3 Single Coil	–	9
13	Terminal Block	431.012.0016	1
–	Tinned Copper Wire	699.099.0072	A/R
14	Connector	421.404.6029	3
–	Wire – Black	450.101.1436	A/R

Resistors

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (PPM)	Code No.
R1	10K	5	2.5W	–	329.104.2202
R2	10K	0.1	⅛W	50	329.000.9408
R3	68K	0.5	⅛W	50	329.000.9476
R4	68K	0.5	⅛W	50	329.000.9476
R5	2K7	5	⅓W	–	326.272.2502
R6	97K6	0.1	⅛W	50	329.000.9528
R7	97K6	0.1	⅛W	50	329 000 9528
R8	48K7	0.1	⅛W	50	329 000.9529
R9	200K	0.1	⅛W	50	329.000.9470
R10	3K3	0.5	⅛W	50	329.331.2102
R11	820	0.5	⅛W	50	329.820.2102
R12	22K	5	⅓W	–	326.223.2502
R13	3K3	5	⅓W	–	326.332.2501
R14	59K	0.5	⅛W	50	329 592.2501
R15	30K1	0.5	⅛W	50	329.303.2502
R16	62K	0.5	⅛W	50	329.623.2102
R17	22K	0.5	⅛W	50	329.223.2101
R18	301K	0.5	⅛W	50	329.304.2502
R19	150K	0.5	⅛W	50	329.154.2202
R20	100K	5	⅓W	–	326.104.2502
R21	100K	5	⅓W	–	326 104 2502
R22	3K9	5	⅓W	–	326.392.2501
R23	8K2	0.5	⅛W	50	329.820.2201
R24	180K	0.5	⅛W	50	329 186.2102
R25	10K	5	⅓W	–	326 103.2501
R26	10K	5	⅓W	–	326 103 2501
R27	4K7	0.5	⅛W	50	329 473.2102
R28	4K7	0 5	⅛W	50	329 473.2102
R29	2K2	0.5	⅛W	50	329 222 6503
R30	1K5	0.5	⅛W	50	329 152 2101
R31	560	0.5	⅛W	50	329 560 2101
R32	4K7	0.5	⅛W	50	329 473 2102
R33	200K	0.5	⅛W	50	329 00 9470
R34	120K	0.5	⅛W	50	329.124 2101
R35	15K	5	⅓W	–	326 153 2502
R36	68K	0.5	⅛W	50	329 000 9476
R37	4M7	5	⅓W	–	326 475 2501
R38	1M	5	⅓W	–	326 105 2501
R39	180K	5	⅓W	–	326 180 2501

Components list – Multi Range

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (ppm)	Code No.
R40	27K	5	⅓W	–	326.273.2501
R41	10K	5	⅓W	–	326.103.2501
R42	68	5	⅓W	–	326.680.2501
R43	10K	5	⅓W	–	326.103 2501
R44	4K	5	⅓W	–	326.472.2502
R45	4K7	0.5	⅛W	50	329 472.2102
R46	348	0.5	⅛W	50	329.340.1101
R47	4K7	0.5	⅛W	50	329.472.2102
R48	2K2	0.5	⅛W	50	329.222.6503
R49	22K	0.5	⅛W	50	329.223.2101
R50	22K	0.5	⅛W	50	329 223.2101
R51	10K	5	⅓W	–	326.103.2501
R52	1K	5	⅓W	–	326.102.2501
R53	3K9	5	⅓W	–	326.392.2501
R54	1K	5	⅓W	–	326.102.2501
R55	1K	5	⅓W	–	326.102.2501
R56	2K15	0.5	⅛W	50	329.212.1101
R68	100K	5	⅓W	–	326.104.2502
R69	100K	5	⅓W	–	326.104.2502
R70	8K2	5	⅓W	–	326.822.2501
R71	47K	5	⅓W	–	326.473.2502
R72	47K	5	⅓W	–	326.473.2502
R73	6K8	5	⅓W	–	326.682.2501
R74	6K8	5	⅓W	–	326.682.2501
R75	680	5	⅓W	–	326.681.2501
R76	6K8	5	⅓W	–	326 682.2501
R77	6K8	5	⅓W	–	326.682.2501
R78	3K6	5	⅓W	–	326.362.2501
R79	1K5	5	⅓W	–	326.152.2501
R86	33K	5	⅓W	–	326.334.2501
R87	6K8	5	⅓W	–	326.682.2501
R88	150K	5	⅓W	–	326.154 2501
R89	2K2	5	⅓W	–	326.222.2502
R90	2K2	5	⅓W	–	326.222.2502
R91	390	5	⅓W	–	–
R92	7M5	5	½W	–	329 705.2101
R93	1M	5	⅓W	–	326.105 2501
R94	7M5	5	½W	–	329 705.2101
R95	100K	5	⅓W	–	326.104 2502
R97	1M	5	⅓W	–	326.105 2501
R98	1K	5	⅓W	–	326.102.2501
R99	820	5	⅓W	–	329 821.2101
R100	12K	5	⅓W	–	326.123 2501
R101	10K	5	2.5W	–	329.104.2202
R102	10K	0.1	⅛W	50	329 000 9408
R103	68K	0.5	⅛W	50	329 000.9476
R104	68K	0.5	⅛W	50	329 000 9476
R105	2K7	5	⅓W	–	326 272.2502
R106	97K6	0.1	⅛W	50	329.000.9528
R107	97K6	0.1	⅛W	50	329 000 9528
R108	48K7	0.1	⅛W	50	329 000 9529
R109	200K	0.1	⅛W	50	329 000 9470
R110	3K3	0.5	⅛W	50	329 331 2102
R111	820	0.5	⅛W	50	329 820 2102
R112	22K	5	⅓W	–	326 223 2502
R113	3K3	5	⅓W	–	326 332 2501
R114	59K	0 5	⅛W	50	329 592 2501
R115	30K1	0.5	⅛W	50	329 303 2502
R116	62K	0 5	⅛W	50	329 623 2102
R117	22K	0 5	⅛W	50	329 223 2101
R120	100K	5	⅓W	–	326 104 2502
R121	100K	5	⅓W	–	326 104 2502
R122	3K9	5	⅓W	–	326 392 2501
R123	8K2	0.5	⅛W	50	329 820 2201
R124	250K	0.5	⅛W	50	329 000 9417
R125	10K	5	⅓W	–	326 103 2501
R126	10K	5	⅓W	–	326 103 2501
R127	4K7	0 5	⅛W	–	329 472 2102
R128	4K7	0.5	⅛W	50	329 472 2102

Components list – Multi Range

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (ppm)	Code No.
R129	2K2	0.5	1/8W	50	329.222.6503
R130	1K5	0.5	1/8W	50	329.152.2101
R131	560	0.5	1/8W	50	329.560.2101
R132	4K7	0.5	1/8W	50	329.472.2102
R133	200K	0.5	1/8W	50	329.000.9470
R134	120K	0.5	1/8W	50	329.124.2101
R135	2K7	5	1/3W	–	326.272.2502
R136	68K	0.5	1/8W	50	329.000.9476
R137	2M2	5	1/3W	–	326.225.2501
R138	1M	5	1/3W	–	326.105.2501
R139	180K	5	1/3W	–	326.180.2501
R140	27K	5	1/3W	–	326.273.2501
R141	10K	5	1/3W	–	326.103.2501
R142	68	5	1/3W	–	326.680.2501
R143	10K	5	1/3W	–	326.103.2501
R144	4K7	5	1/3W	–	326.472.2502
R145	4K7	0.5	1/8W	50	329.472.2102
R146	255R	0 5	-	50	329 250.1101
R147	4K7	0 5	-	50	329 472.2102
R148	2K2	0.5	–	50	329 222 6503
R149	22K	0 5	-	50	329.233.2101
R150	22K	0 5	–	50	329 223.2101
R151	10K	5	1/3W	–	326 103.2501
R152	1K	5	1/3W	–	326.102.2501
R153	3K9	5	1/3W	–	326 392.2501
R154	1K	5	1/3W	–	326 102.2501
R155	1K	5	1/3W	–	326.102 2501
R156	1K58	0 5	-	50	329 182 1101
R157	10K	0 1	–	50	329.000.9408
R158	10K	5	1/3W	–	326 103 2501
R159	3K9	0 5	–	50	329 390.2103
R160	100K	5	1/3W	-	326.104 2502
R161	100K	5	1/3W	–	326 104.2502
R162	8K2	0 5	–	50	326 822.2501
R163	100K	5	1/3W	–	326 104 2502
R164	100K	5	1/3W	–	326.104.2502
R165	100K	5	1/3W		326 104.2502
R166	10K	5	1/3W	-	326 103 2501
R167	220K	5	1/3W		326 224.2502
R168	100K	5	1/3W	-	326 104 2502
R170	5K9	0 1	–	50	329 000 9462
R171	100K	0 1	–	50	329 000 9400
R172	10K	0.1	1/8W	50	329.000.9408
R173	240	0.1	1/8W	50	329.000 9442

Capacitors

C1	2200µF	–	25V	–	313.201 3002
C2	2200µF	–	25V	–	313.201.3002
C3	2200µF	–	40V	–	313.201.3005
C4	2200µF	–	25V	–	313.201 3002
C5	2200µF	–	25V	–	313.201.3002
C6	0.15µF	–	250V	–	307.153.5502
C7	0.1µF	–	250V	–	313.104.3004
C8	0.1µF	–	250V	–	313.104 3004
C9	0.1µF	–	–	–	313.100.6322
C10	100PF	–	–	–	313.100.6322
C11	330PF	–	–	–	307 331.5001
C12	33nF	1	63V	–	306 222.5203
C13	33nF	1	63V	–	306 222 5203
C14	33nF	1	63V	-	306 222 5203
C15	33nF	1	63V		306 222 5203
C16	100PF				313 100 6322
C17	0 22µF		160V		306 224 5202
C18	10nF		250V		307 103 3001
C19	4µF	-	25V	-	320 405 2502
C20	22nF	-	250V	-	313.223 3001
C21	0.1µF		250V		313 104 3004
C22	0.1µF	-	250V	-	313.104 3004
C23	0.15µF	5	160V	-	306 154 5201
C25	0.1µF	-	250V	-	313 104 3004
C26	4nF	–	–	–	313.472.1002
C27	4µF	–	25V	–	320.405.2502
C28	0.1µF	–	250V	–	313.104.3004
C29	0.1µF		25V	–	320.405.2502
C30	4µF	–	25V	–	320.405.2502
C31	10µF	–	16V	–	320.106.1601
C32	10µF	–	63V	–	313.100.6329
C33	10µF	–	63V	–	313.100.6329
C34	22µF	–	25V	–	320.207.1002
C35	100PF	–	–	–	313.100.6322
C36	10nF	–	1KV	–	313.100.6330
C37	10nF	–	1KV	–	313.100.6330
C38	10nF	–	1KV	–	313.100.6330
C39	10nF	–	1KV	–	313.100.6330
C40	0.15	–	250V	–	307.153.5502
C41	0.1	–	250V	–	313.104.3004
C42	0.1	–	250V	–	313.104.3004
C43	100PF	–	–	–	313.100.6322
C44	100PF	–	–	–	313.100.6322
C45	330PF	–	–	–	307.331.5001
C46	33nF	1	63V	–	306.222.5203
C47	33nF	1	63V	–	306 222.5203
C48	33nF	1	63V	–	306.222.5203
C49	33nF	1	63V	–	306.222.5203
C50	100PF	–	–	–	313.100.6322
C51	0.22µF	–	160V	–	306.224.5202
C52	10nF	–	250V	–	307.103.3001
C53	4µ7	–	25V	–	320.405.2502
C54	15n	–	250V	–	307.153.5502
C55	0.1µ	–	250V	–	313.104.3004
C56	0.1µ	–	250V	–	313.104.3004
C57	0.15µ	–	160V	–	306.154.5201
C59	0.1µ	–	250V	–	313.104.3004
C60	47nF	–	–	–	313.472.1002
C61	4µ7	–	25V	–	320.405.2502
C62	0.1µ	–	250V	–	313.104.3004
C63	0.1µ	–	250V	–	313.104.3004
C64	4µ7	–	25V	–	320.405.2502
C65	2µ2	–	63V	–	320.255.0401
C66	0.1µ	–	250V	–	313.104 3004
C67	33PF	–	160V	–	306 300 5000
C68	0.047µF	–	250V	–	313.503.3002
C69	0.047µF	–	250V	–	313.503 3002
C70	2µ2	–	63V	–	320 255.0401
C71	33PF	–	160V	–	306.300.5000
C72	10nF	–	250V	–	307.103 3001
C73	1nF	–	–	–	313.100 6310
C74	1nF	–	–	–	313.100 6310
C75	0.1µF	–	250V	–	313.104.3004
C77	2µF	–	63V	–	320 255.0401
C78	2µF	–	63V	–	320 255.0401

Diodes

D1	BZY88	–	C10V0	-	336 008 0021
D2	BZY88	–	C10V0	-	336 008 0021
D3	IN4148	–	–	–	337 004 0017
D4	IN4148	–	-		337 004 0017
D5	IN4148	–	–	–	337 004 0017
D6	IN4148	-	-	-	337 004 0017
D7	IN4148	-	-	-	337 004 0017
D8	IN4148	–	–	-	337 004 0017
D9	IN4148		–	-	337 004 0017
D10	IN4148	-	–	–	337 004 0017
D11	IN4148	–	–	-	337 004 0017
D12	IN4148	–		-	337 004 0017
D13	IN4148	–	–	-	337 004 0017
D16	IN4148	–	–	-	337 004 0017

Components list – Multi Range

Component			Code No.
D17	IN4148		337.004.0017
D18	BZX79	C10V0	336.008.0007
D19	IN4004		336.004.0006
D20	IN4004		336.004.0006
D21	IN4004		336.004.0006
D22	IN4004		336.004.0006
D23	IN4148		337.004.0017
D31	BZY88	C10V0	336.008.0021
D32	BZY88	C10V0	336.008.0021
D33	IN4148		337.004.0017
D34	IN4148		337.004.0017
D35	IN4148		337.004.0017
D36	IN4148		337.004.0017
D37	IN4148		337.004.0017
D38	IN4148		337.004.0017
D41	IN4148		337.004.0017
D44	IN4004		336.004.0006
D45	IN4004		336.004.0006
D46	IN4004		336.004.0006
D47	IN4004		336.004.0006

Transistors

TR1	2N3904		337.006.0018
TR2	2N3904		337.006.0018
TR3	2N3904		337.006.0018
TR4	2N3904		337.006.0018
TR5	2N3906		337.006.0002
TR6	2N3904		337.006.0018
TR7	BD137		337.005.0014
TR10	2N3904		337.006.0018
TR11	2N3904		337.006.0018
TR12	2N3904		337.006.0018

Variable Resistors

VR1	MC78L12CP	351.091.0019
VR2	MC79L12CP	351.091.0130
VR3	MC78L05CP	351.091.0131
VR4	MC78L12CP	351.091.0119
VR5	MC79L12CP	351.091 0130

Bridge Rectifiers

BR1	IR TYPE ISB 05A	338.000 0024
BR2	IR TYPE ISB 05A	338.000.0024
BR3	IR TYPE ISB 05A	338.000.0024

Integrated Circuits

IC1	LM321H	351.091.0012
IC2	LM308AN	351.091.0056
IC3	LM308AN	351.091.0056
IC4	LM741CN	351.091.0068
IC5	LM339N	351.091.0086
IC6	LM741CN	351.091.0068
IC7	LM741CN	351.091.0068
IC8	LM378N	351.091.0128
IC9	REF 02DP	351.091.0129
IC10	LM 741CN	351 091 0068
IC11	4011 BE	351 091.0125
IC12	IL1	351 091 0106
IC13	4012 BE	351 091 0126
IC14	CA3140E	351 091 0127
IC15	IC4011BE	351 091 0125
IC16	LM321H	351 091 0012
IC17	LM308AN	351 091 0056
IC18	LM308AN	351 091 0056
IC19	LM741CN	351 091 0068
IC20	LM339N	351 091 0086
IC21	LM741CN	351 091 0068
IC22	LM741CN	351.091.0068
IC23	LM378N	351.091.0128
IC24	REF 02DP	351.091.0129
IC25	LM741CN	351.091.0068

Potentionometers

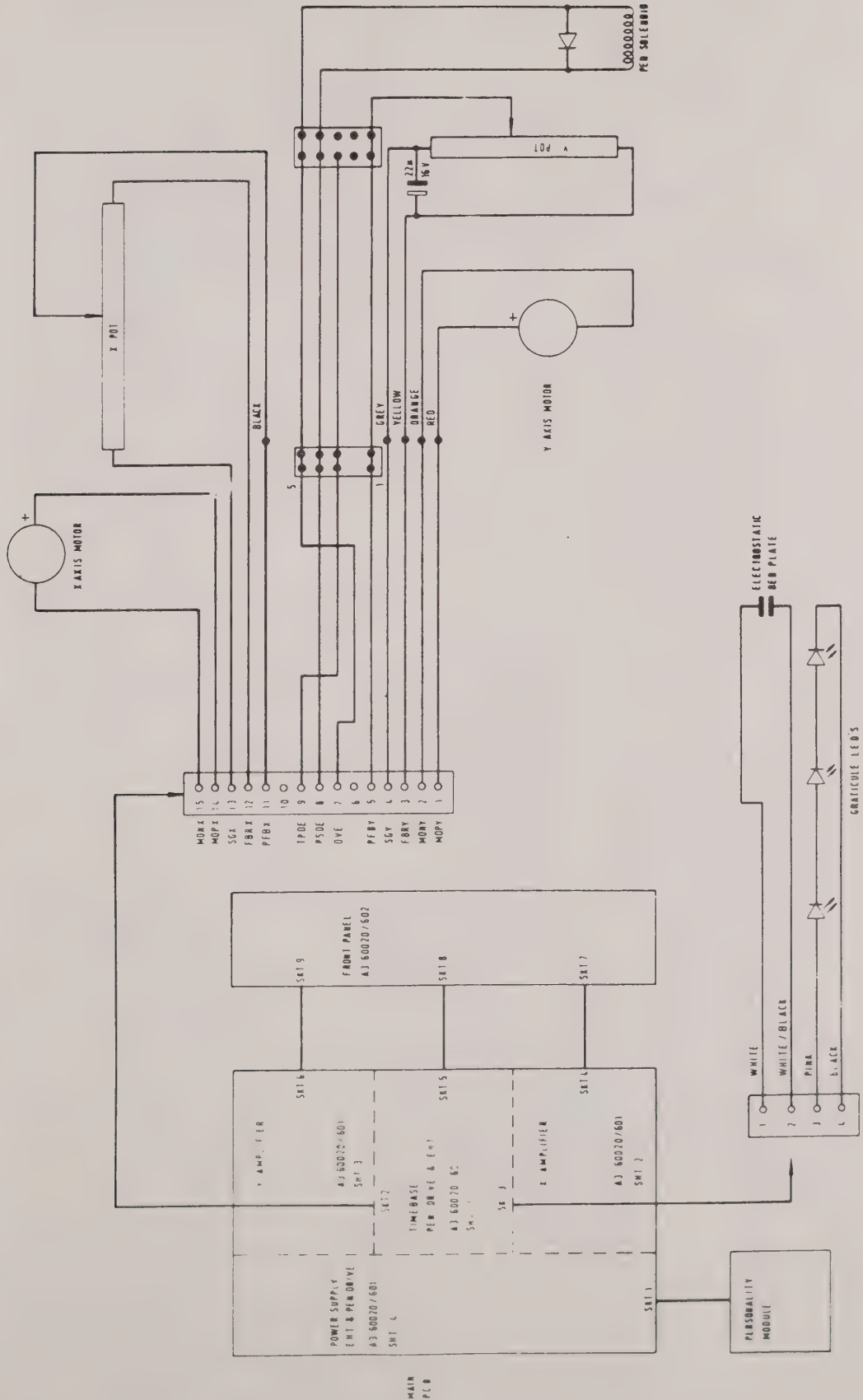
P1	5K	331.503.1266
P2	50K	331.503.1264
P3	500K	331.503.1269
P4	500K	331.503.1269
P5	50K	331.503.1264
P6	10K	331.103.1426
P7	50	331.503.1268
P11	5K	331.503.1266
P12	50K	331.503.1264
P13	500	331.503.1269
P14	500	331.503.1269
P15	50K	331.503.1264

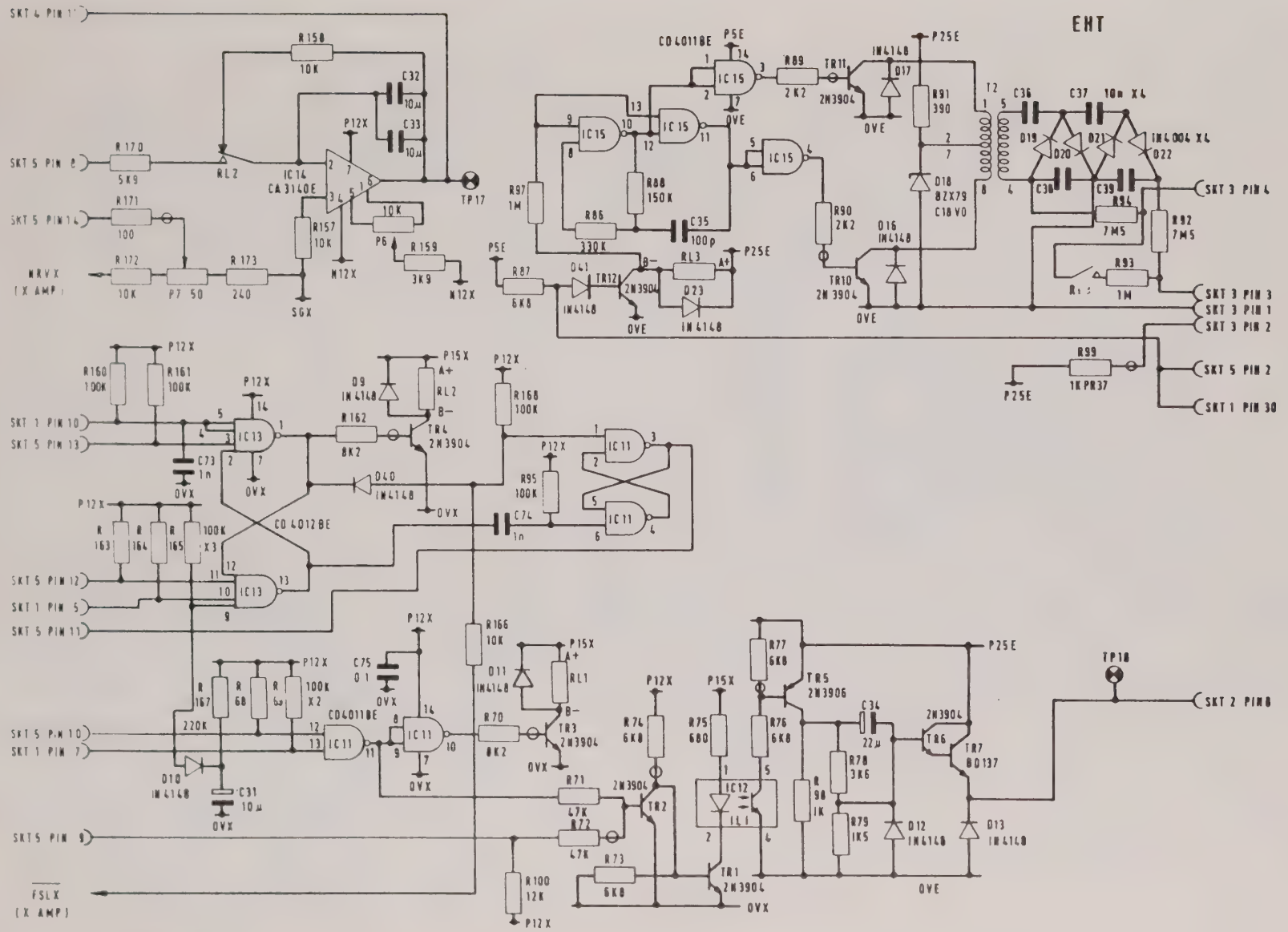
Relays

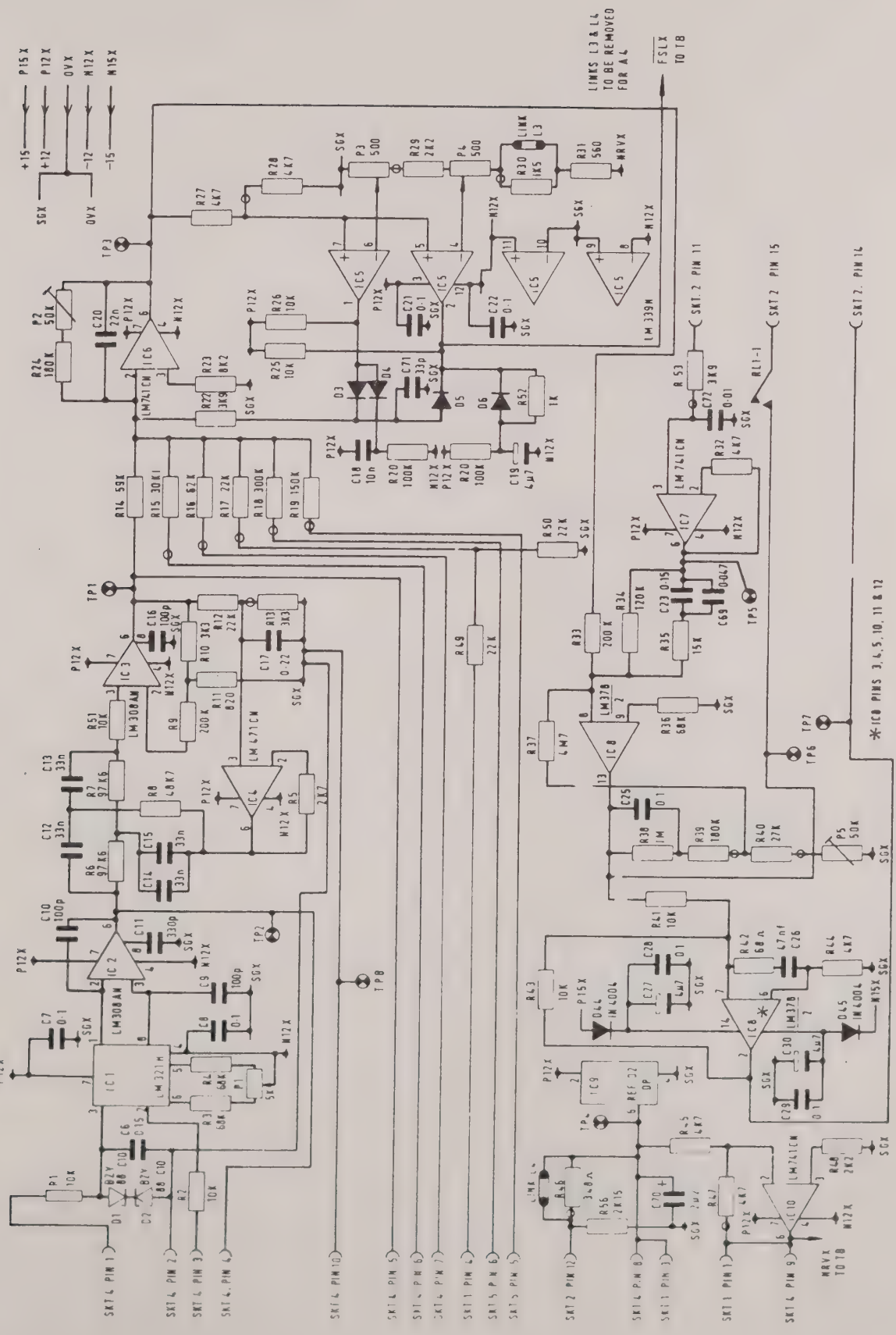
RL1	PMP2-2A-12V-680R	364.200.0056
RL2	PM1-1C-12V-820R	364.200.0055
RL3	ED-13704/A	364.200.0057

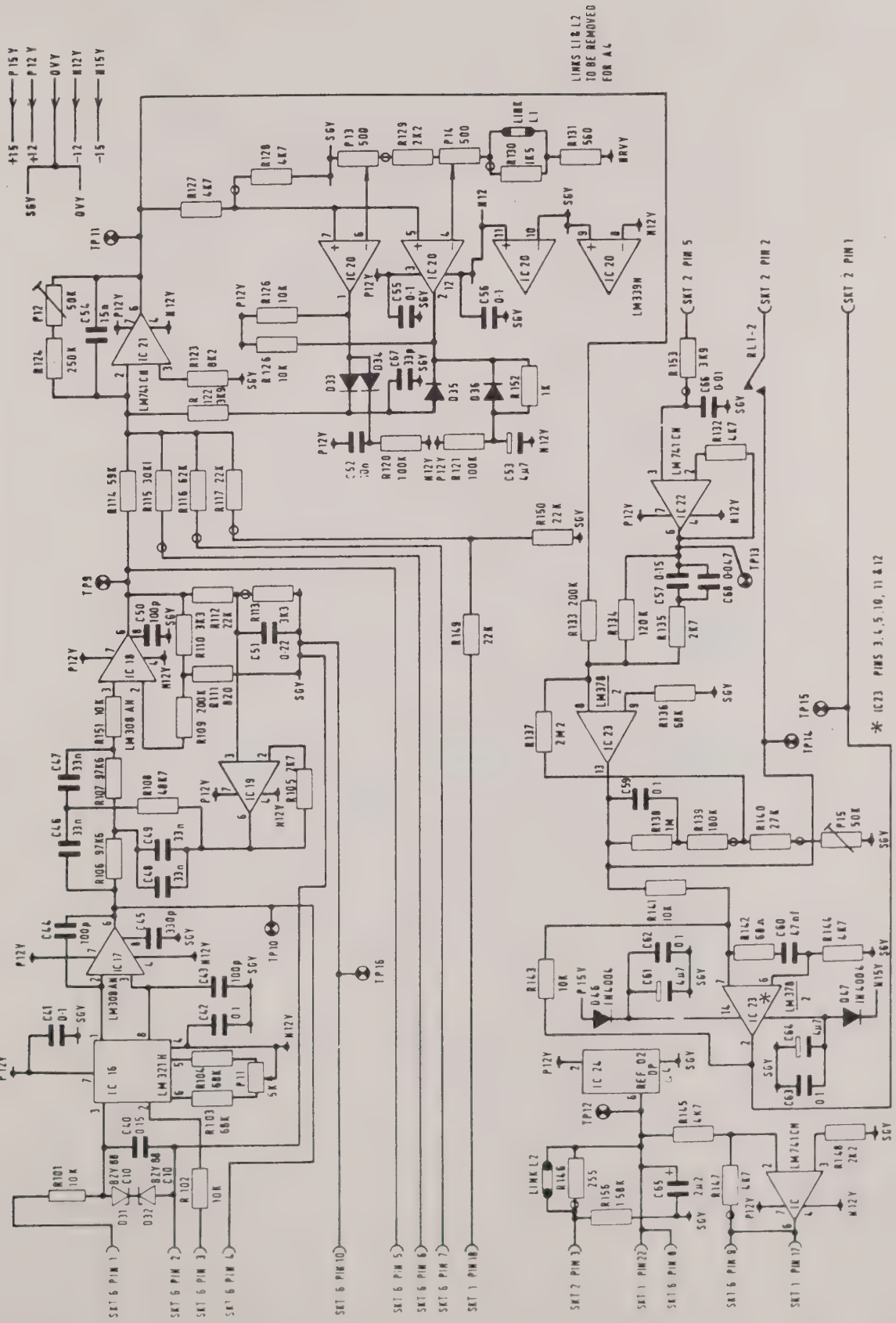
Connectors

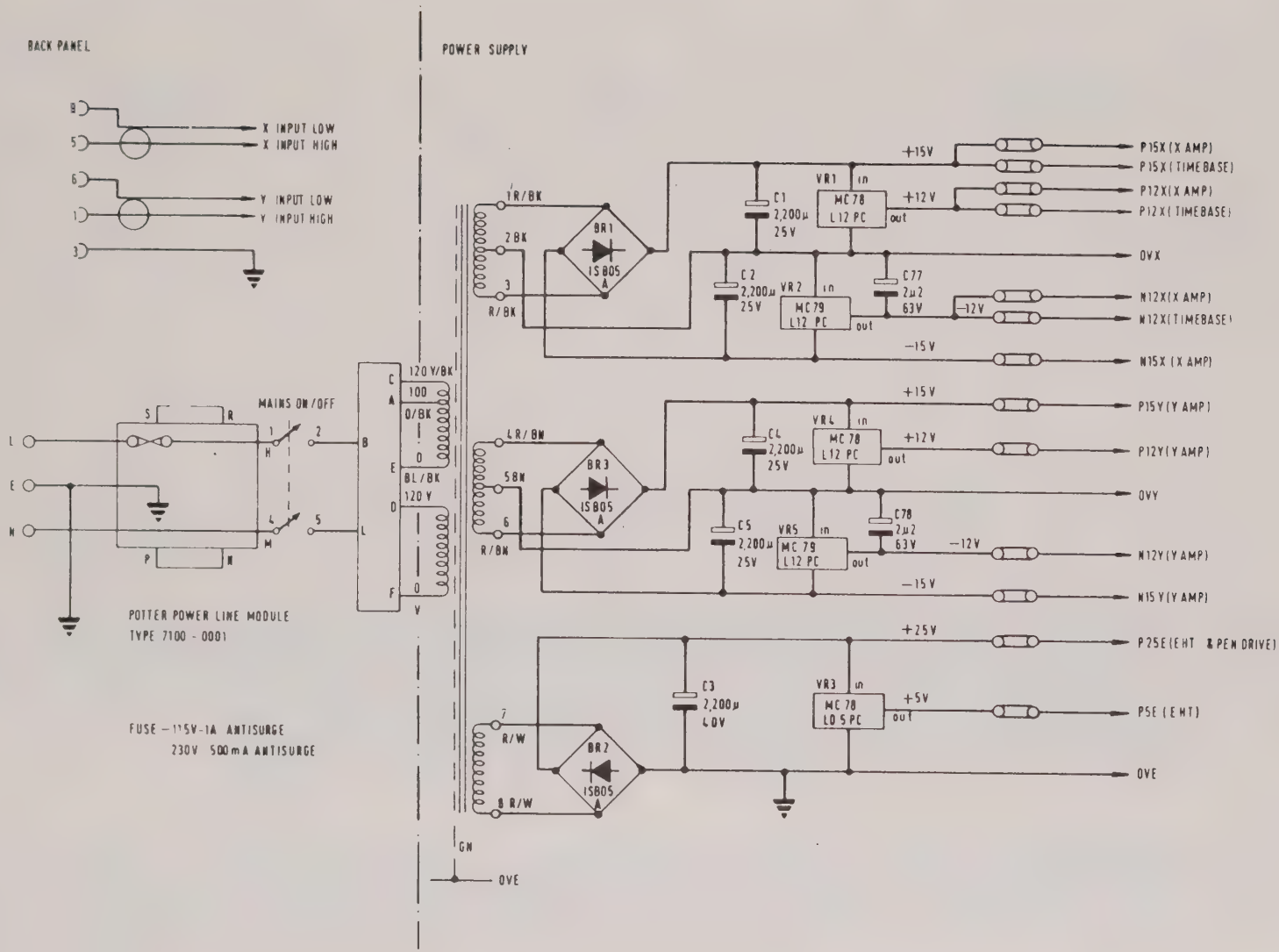
AMP TYPE	825433	421.404.6040
MINI SHUNT AMP TYPE	141767-1	421.404.6039

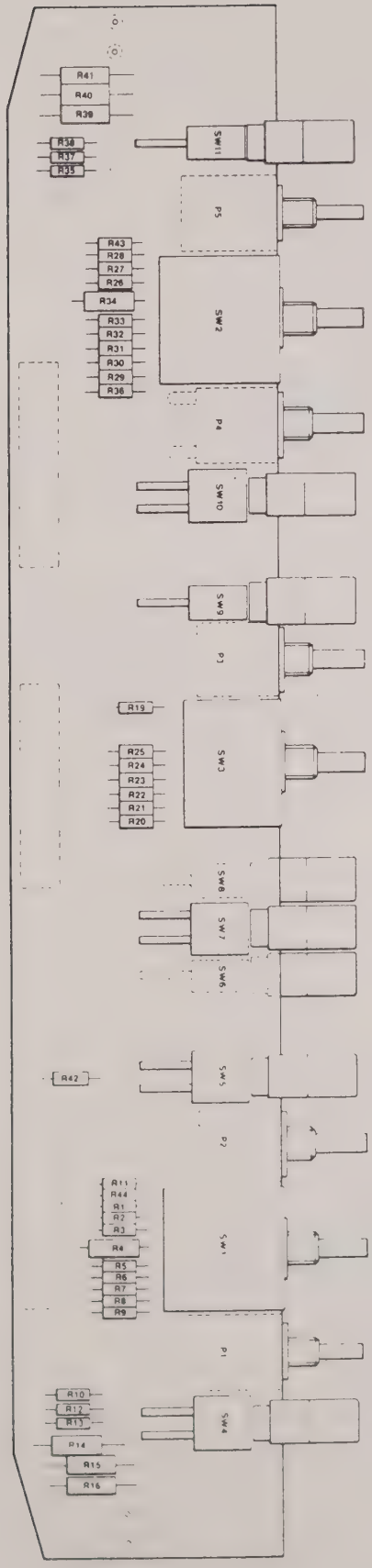

PCB SOLENOID
Y POT
22u 16V
X POT
BLACK
GREY
YELLOW
ORANGE
RED
Y AXIS MOTOR
X AXIS MOTOR
ELECTROSTATIC DEF PLATE
GRATICULE LED'S
WHITE
WHITE / BLACK
PINK
BLACK
MOPX
SGX
FBBX
PFBX
IPOE
PSOE
OVE
PFBY
SGY
FBBY
MOPY
FRONT PANEL
AJ 60020/602
SK19
SK18
SK17
SK16
SK15
SK14
SK12
SK13
SK11
SK1
SK2
SK3
SK4
SK5
SK6
SK7
SK8
SK9
SK10
POWER SUPPLY
AJ 60020/601
SWI 4
TIMEBASE
AJ 60020/601
SWI 3
Y AMPLIFIER
AJ 60020/601
SWI 2
PERSONALITY MODULE
MAIN PCB


EHT
TIME BASE
PEN DRIVE
SKT 4 PIN 1
SKT 5 PIN 8
SKT 5 PIN 14
NRVX (X AMP)
FSLX (X AMP)
SKT 1 PIN 10
SKT 5 PIN 13
SKT 5 PIN 12
SKT 1 PIN 5
SKT 5 PIN 11
SKT 5 PIN 10
SKT 1 PIN 7
SKT 5 PIN 9
SKT 3 PIN 4
SKT 3 PIN 3
SKT 3 PIN 1
SKT 3 PIN 2
SKT 5 PIN 2
SKT 1 PIN 30
SKT 2 PIN 8
TP17
TP18
IC14 CA3140E
CD4011BE
CD4012BE
TR1 2N3904
TR2 2N3904
TR3 2N3904
TR4 2N3904
TR5 2N3906
TR6 2N3904
TR7 BD137
TR10 2N3904
TR11 2N3904
TR12 2N3904
D18 BZX79 C18V0
IN4004 X4
IN4148

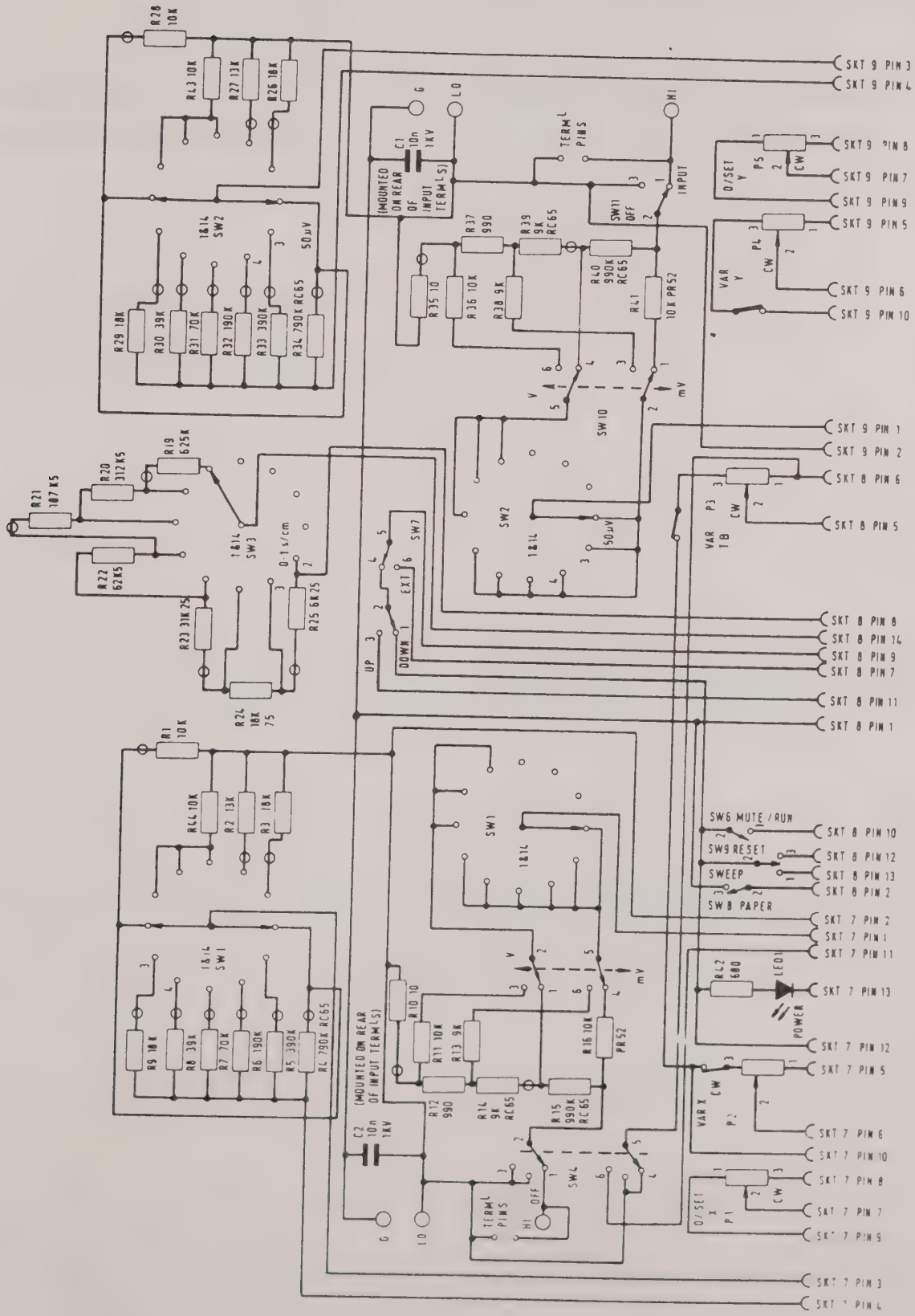

+15
+12
0VX
-12
-15
P15X
P12X
0VX
M12X
M15X
SGX
LINKS L3 & L4 TO BE REMOVED FOR A4
FSLX TO TB
LINK L3
MRVX
SKT 2 PIN 11
SKT 2 PIN 15
SKT 2 PIN 14
RL1-1
LM 339M
LM741CN
LM308AN
LM 321M
LM4250
LM378
REF 02 OP
IN4004
*IC8 PINS 3, 4, 5, 10, 11 & 12
SKT 4 PIN 1
SKT 4 PIN 2
SKT 4 PIN 3
SKT 4 PIN 4
SKT 4 PIN 10
SKT 4 PIN 5
SKT 4 PIN 6
SKT 4 PIN 7
SKT 1 PIN 4
SKT 5 PIN 6
SKT 5 PIN 5
SKT 2 PIN 12
SKT 4 PIN 8
SKT 1 PIN 3
SKT 1 PIN 1
SKT 4 PIN 9
MRVX TO TB




BACK PANEL
POWER SUPPLY
X INPUT LOW
X INPUT HIGH
Y INPUT LOW
Y INPUT HIGH
MAINS ON/OFF
POTTER POWER LINE MODULE
TYPE 7100 - 0001
FUSE – 115V-1A ANTISURGE
230V 500mA ANTISURGE
120V/BK
100
O/BK
BL/BK
120V
1R/BK
2BK
3
R/BK
BR1
IS805
A
C1
2,200µ
25V
VR1
MC 78
L12 PC
+15V
+12V
C2
2,200µ
25V
VR2
MC79
L12 PC
C77
2µ2
63V
-12V
-15V
P15X(X AMP)
P15X(TIMEBASE)
P12X(X AMP)
P12X(TIMEBASE)
OVX
N12X(X AMP)
N12X(TIMEBASE)
N15X(X AMP)
LR/BN
5BN
6
R/BN
BR3
IS805
A
C4
2,200µ
25V
VR4
MC 78
L12 PC
C5
2,200µ
25V
VR5
MC 79
L12 PC
C78
2µ2
63V
P15Y(Y AMP)
P12Y(Y AMP)
OVY
N12Y(Y AMP)
N15Y(Y AMP)
+25V
C3
2,200µ
40V
VR3
MC 78
L05 PC
+5V
7
R/W
8 R/W
BR2
IS805
A
P25E(EHT & PEN DRIVE)
P5E(EHT)
OVE
GN
OVE



Item No./ Component	Description	Code No.	Qty
1	Front Panel PCB	60000/501	1
2	Connector	421.404.6030	3
3	PCB Pins	713.005 0005	4
R1	10kΩ ± 0.1% 50 PPM	329.000.9408	
R2	13kΩ ± 0.1% 50 PPM	329.000.9526	
R3	18kΩ ± 0.1% 50 PPM	329.000.4445	
R4	790kΩ ± 0.1% 50 PPM	329.000.9521	
R5	390kΩ ± 0.1% 50 PPM	329.000.9467	
R6	190kΩ ± 0.1% 50 PPM	329.000.9523	
R7	70kΩ ± 0.1% 50 PPM	329.000.9524	
R8	39kΩ ± 0.1% 50 PPM	329.000.9525	
R9	18kΩ ± 0.1% 50 PPM	329.000.9445	
R10	10Ω ± 0.1% 50 PPM	329.000.9468	
R11	10kΩ ± 0.1% 50 PPM	329.000.9408	
R12	990Ω ± 0.1% 50 PPM	329.000.9527	
R13	9kΩ ± 0.1% 50 PPM	329.000.9407	
R14	9kΩ ± 0.1% 50 PPM	329.000.9530	
R15	990kΩ ± 0.1% 50 PPM	329.000.9520	
R16	10kΩ ± 0.1% 50 PPM	329.104.2202	
R19	625kΩ ± 0.1% 50 PPM	329.000.9522	
R20	312k5Ω ± 0.1% 50 PPM	329.000 9461	
R21	187k5Ω ± 0.1% 50 PPM	329.000.9458	
R22	62k5Ω ± 0.1% 50 PPM	329 000.9429	
R23	31k25Ω ± 0.1% 50 PPM	329.000.9460	
R24	18k75Ω ± 0.1% 50 PPM	329.000.9457	
R25	6k25Ω ± 0.1% 50 PPM	329.000.9425	
R26	18kΩ ± 0.1% 50 PPM	329.000.9445	
R27	13kΩ ± 0.1% 50 PPM	329.000.9526	
R28	10kΩ ± 0.1% 50 PPM	329.000.9408	
R29	18kΩ ± 0.1% 50 PPM	329.000.9445	
R30	39kΩ ± 0.1% 50 PPM	329.000.9525	
R31	70kΩ ± 0.1% 50 PPM	329 000.9524	
R32	190kΩ ± 0 1% 50 PPM	329.000.9523	
R33	390kΩ ± 0.1% 50 PPM	329.000.9467	
R34	790kΩ ± 0.1% 50 PPM	329.000.9521	
R35	10Ω ± 0.1% 50 PPM	329 000.9468	
R36	10kΩ ± 0.1% 50 PPM	329.000.9408	
R37	990kΩ ± 0.1% 50 PPM	329.000.9527	
R38	9kΩ ± 0.1% 50 PPM	329.000.9407	
R39	9kΩ ± 0.1% 50 PPM	329 000.9530	
R40	990kΩ ± 0.1% 50 PPM	329.000.9520	
R41	10kΩ ± 5% 2.5W	329 104 2202	
R42	680Ω ± 5% CR25	326 681 2501	
R43	10kΩ ± 0.1% 50 PPM	329.000 9408	
R44	10kΩ ± 0 1% 50 PPM	329 000 9408	
SW1	1 Pole 9 Way/2 Pole 6 Way	690 001.0718	
SW2	1 Pole 9 Way/2 Pole 6 Way	690.001 0718	
SW3	1 Pole 8 Way	690 001.0719	
SW4	2 Pole c/o 3 Psn.	355.019.0036	
SW5	2 Pole c/o	355.019 0034	
SW6	1 Pole c/o	355.019 0035	
SW7	2 Pole c/o 3 Psn.	355.019 0036	
SW8	1 Pole c/o	355.019 0035	
SW9	1 Pole c/o 3 Psn.	355.019 0037	
SW10	2 Pole c/o	355 019.0034	
SW11	1 Pole c/o	355 019 0035	
P1	10 Turn 100k	331 104 4325	
P2	1 Turn 10k	331.103 1433	
P3	1 Turn 10k	331.103 1433	
P4	10 Turn 100k	331 104 4325	


R28 10K
R43 10K
R27 13K
R26 18K
SW2
R29 18K
R30 39K
R31 70K
R32 190K
R33 390K
R34 790K RC65
50µV
C1 10n 1KV
(MOUNTED ON REAR OF INPUT TERMS)
G
LO
HI
TERMS
SW11 OFF
INPUT
R37 990
R39 9K RC65
R40 990K RC65
R41 10K PR52
R35 10
R36 10K
R38 9K
SW10
V
mV
O/SET Y
VAR Y
SKT 9 PIN 3
SKT 9 PIN 4
SKT 9 PIN 8
SKT 9 PIN 7
SKT 9 PIN 9
SKT 9 PIN 5
SKT 9 PIN 6
SKT 9 PIN 10
SKT 9 PIN 1
SKT 9 PIN 2
SKT 8 PIN 6
SKT 8 PIN 5
R19 625K
R20 312K5
R21 187K5
R22 62K5
R23 31K25
R24 10K 75
R25 6K25
SW3
0·1s/cm
SW7
EXT
UP
DOWN
VAR P3 1B
SKT 8 PIN 8
SKT 8 PIN 14
SKT 8 PIN 9
SKT 8 PIN 7
SKT 8 PIN 11
SKT 8 PIN 1
R1 10K
R44 10K
R2 13K
R3 18K
SW1
R9 18K
R8 39K
R7 70K
R6 190K
R5 390K
R4 790K RC65
SW6 MUTE / RUN
SW9 RESET
SWEEP
SW8 PAPER
SKT 8 PIN 10
SKT 8 PIN 12
SKT 8 PIN 13
SKT 8 PIN 2
SKT 7 PIN 2
SKT 7 PIN 1
SKT 7 PIN 11
R42 680
LED1
POWER
SKT 7 PIN 13
SKT 7 PIN 12
SKT 7 PIN 5
VAR X P2
SKT 7 PIN 6
SKT 7 PIN 10
SKT 7 PIN 8
SKT 7 PIN 7
SKT 7 PIN 9
O/SET X P1
R10 10
R11 10K
R13 9K
R16 10K PR52
R12 990
R14 9K RC65
R15 990K RC65
C2 10n 1KV
(MOUNTED ON REAR OF INPUT TERMS)
SW4
OFF
SKT 7 PIN 3
SKT 7 PIN 4

Willow Lane, Mitcham, Surrey CR4 4UL.
Telephone 01-640 3490 Telex 946097

GOULD Bryans

Section 3:2
A3 and A4 Systems

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **Systems**

Information contained in this section

Circuit diagrams and component lists for all electronics relevant to the 60000 A3 and A4 Systems unit.

General information

Power Supply

A toroidal mains transformer is used with three separate secondary windings each having an integrated bridge rectifier and either one or two integrated regenerators associated with it. Ten voltage levels are generated, referred to three ground levels. X axis amplifiers and timebase use ±16v unregulated and ± 12v regulated supplies referred to 0v X. Y axis amplifiers use ±16v unregulated and ± 12v regulated supplies referred to 0v Y. The control and drive circuitry for electrostatic hold-down, pen solenoid and logic and switching functions use +25v unregulated and +5v regulated supplies.

X and Y signal and servo amplifiers

Input signals to the recorder are attenuated by the sensitivity control circuitry on the instrument front panel, this attenuated signal is applied to the signal amplifiers on the main p.c.b.

The first of these is a pre-amp, op-amp combination, the gain of which is set by the sensitivity controls on the front panel. The second stage of amplification incorporates an active notch filter at the line frequency. At the next stage, offset, variable sensitivity, external offset and variable timebase (X only) are summed with the input signal – and the electronic limit control signal is applied.

The output from this stage is then summed with the position feedback signal at the input of the servo amplifier. This final stage consists of two power op-amps connected in a bridge circuit supplying drive to the servo motors which move the gantry and pen carriage.

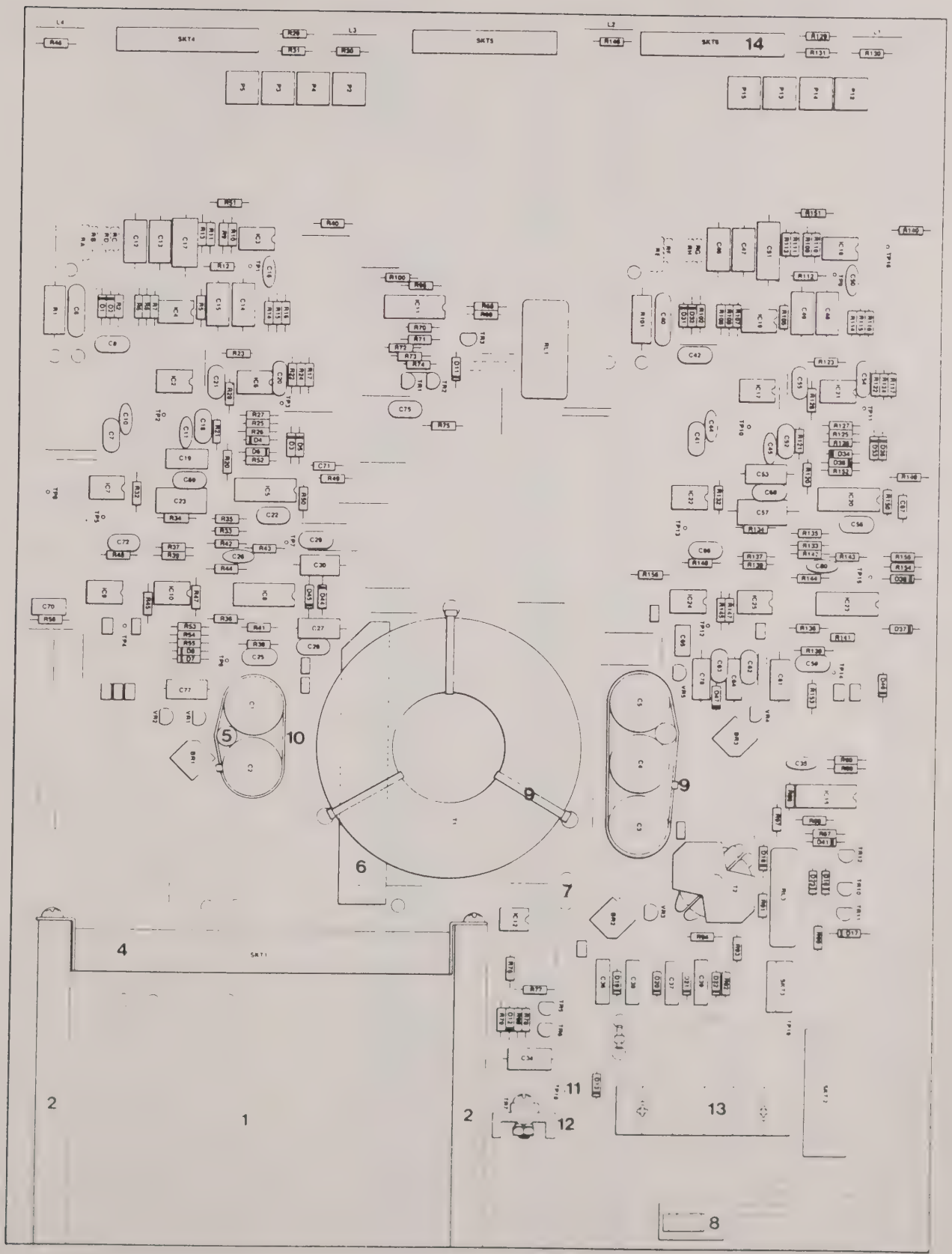
Timebase

An integrator is used to generate a linear ramp which is fed into the third stage of the X amplifier chain. Input current to the integrator is controlled over two decades by the s.cm switch on the front panel. The front panel variable control reduces the feedrate selected by attenuating the signal fed to the X amplifier chain.

Controls etc.

Eht for electrostatic hold-down is provided by an oscillator driving a step-up transformer into a voltage quadrupler. The resulting output of approx. 1Kv is applied to the bed-plate.

The pen is controlled by the timebase circuit and the front panel switch, the control signal being opto-coupled to the earth referenced drive circuit. The pen down command initially applies a high voltage to the pen solenoid this voltage decaying to a lower holding level.


1
2
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14

Component	Description	Code No.	Qty
1	Main PCB	60000/502	1
2	Personality PCB Guide	60000/544	2
3	Film Wire Connector	60000/69	1
4	Personality Module Connector	60000/587	1
T1	Power Supply Transformer	60000/560	1
T2	Paper Hold Transformer	50000/57	1
5	Capacitor Support	60000/584	2
6	Scotch Electrical Tape	485.002.0317	A/R
7	Ty-Rap Ty23M	718.700.1001	14
–	Screw M3 × 6 Pozi Pan	–	6
–	Nut M3 Square	–	4
–	Screw M3 × 6 Pozi Pan Taptite	–	2
–	Screw M3 × 20 Pozi Pan	–	2
8	Cable Clip	718.100.0119	1
9	Ty-Rap Ty 525M	718.700.1004	4
10	Ty-Rap Ty 24M	718.700.1002	1
11	PCB Pins	713.005.0005	28
Skt 3	4 Way Connector	421.614.7041	1
12	Heatsink	415.100 0003	1
–	Screw M3 × 10 Pozi Pan	–	1
–	Nut M3 Hex	–	3
–	Washer M3 Single Coil	–	9
13	Terminal Block	431.012.0016	1
–	Tinned Copper Wire	699.099 0072	A/R
14	Connector	421.404.6029	3
–	Wire – Black	450.101.1436	A/R

Resistors

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (PPM)	Code No.
RA	990K	0.1	¼W	50	329 000.9520
RB	10K	0.1	⅛W	50	329.000.9408
RC	39K	0.1	⅛W	50	329 000 9525
RD	13K	0.1	⅛W	50	329 000 9526
RE	990K	0.1	¼W	50	329 000.9520
RF	10K	0.1	⅛W	50	329.000 9408
RG	39K	0.1	⅛W	50	329 000 9525
RH	13K	0.1	⅛W	50	329 000 9526
R1	10K	5	2.5W	–	329 104 2202
R2	10K	0.1	⅛W	50	329.000.9408
R5	2K7	5	⅓W	–	326.272.2502
R6	97K6	0.1	⅛W	50	329 000.9528
R7	97K6	0.1	⅛W	50	329.000 9528
R8	48K7	0.1	⅛W	50	329 000 9529
R9	200K	0.1	⅛W	50	329 000 9470
R10	3K3	0.5	⅛W	50	329 331 2102
R11	820	0.5	⅛W	50	329 820 2102
R12	22K	5	⅓W	–	326 223.2502
R13	3K3	5	⅓W	–	326 332.2501
R14	59K	0.5	⅛W	50	329.592.2501
R15	30K1	0.5	⅛W	50	329 303 2502
R16	62K	0.5	⅛W	50	329 623 2102
R17	22K	0.5	⅛W	50	329 223.2101
R20	100K	5	⅓W	–	326.104 2502
R21	100K	5	⅓W	–	326 104 2502
R22	3K9	5	⅓W	–	326 392.2501
R23	8K2	0.5	⅛W	50	329 820 2201
R24	180K	0.5	⅛W	50	329 186 2102
R25	10K	5	⅓W	–	326 103 2501
R26	10K	5	⅓W	–	326 103 2501
R27	4K7	0 5	⅛W	50	329 473 2102
R28	4K7	0 5	⅛W	50	329 473 2102
R29	2K2	0 5	⅛W	50	329 222 6503
R30	1K5	0 5	⅛W	50	329 152 2101
R31	560	0.5	⅛W	50	329 560 2101
R32	4K7	0.5	⅛W	50	329 473 2102
R33	200K	0.5	⅛W	50	329 00 9470
R34	120K	0 5	⅛W	50	329 124 2101

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (ppm)	Code No.
R35	15K	5	⅓W	–	326 153 2502
R36	68K	0.5	⅛W	50	329 000 9476
R37	4M7	5	⅓W	–	326 475 2501
R38	1M	5	⅓W	–	326 105.2501
R39	180K	5	⅓W	–	326.180 2501
R40	27K	5	⅓W	–	326 273.2501
R41	10K	5	⅓W	–	326.103 2501
R42	68	5	⅓W	–	326 680 2501
R43	10K	5	⅓W	–	326.103 2501
R44	4K	5	⅓W	–	326 472 2502
R45	4K7	0.5	⅛W	50	329 472 2102
R46	348	0.5	⅛W	50	329 340 1101
R47	4K7	0.5	⅛W	50	329 472 2102
R48	2K2	0 5	⅛W	50	329 222 6503
R49	22K	0.5	⅛W	50	329 223 2101
R50	22K	0 5	⅛W	50	329 223 2101
R51	10K	5	⅓W	–	326 103 2501
R52	1K	5	⅓W	–	326 102 2501
R53	3K9	5	⅓W	–	326 392 2501
R54	1K	5	⅓W	–	326 102 2501
R55	1K	5	⅓W	–	326 102 2501
R56	2K15	0 5	⅛W	50	329 212 1101
R68	100K	5	⅓W	–	326 104 2502
R69	100K	5	⅓W	–	326 104 2502
R70	8K2	5	⅓W	–	326 822 2501
R71	47K	5	⅓W	–	326 473 2502
R72	47K	5	⅓W	–	326 473 2502
R73	6K8	5	⅓W	–	326 682 2501
R74	6K8	5	⅓W	–	326 682 2501
R75	680	5	⅓W	–	326 681 2501
R76	6K8	5	⅓W	–	326 682 2501
R77	6K8	5	⅓W	–	326 682 2501
R78	3K6	5	⅓W	–	326 362 2501
R79	1K5	5	⅓W	–	326 152 2501
R86	33K	5	⅓W	–	326 334 2501
R87	6K8	5	⅓W	–	326 682 2501
R88	150K	5	⅓W	–	326 154 2501
R89	2K2	5	⅓W	–	326 222 2502
R90	2K2	5	⅓W	–	326 222 2502
R91	390	5	⅓W	–	–
R92	7M5	5	½W	–	329 705 2101
R93	1M	5	⅓W	–	326 105 2501
R94	7M5	5	½W	–	329 705 2101
R95	100K	5	⅓W	–	326 104 2502
R97	1M	5	⅓W	–	326 105 2501
R98	1K	5	⅓W	–	326 102 2501
R99	820	5	⅓W	–	329 821 2101
R100	12K	5	⅓W	–	326 123 2501
R101	10K	5	2 5W	–	329 104 2202
R102	10K	0.1	⅛W	50	329 000 9408
R105	2K7	5	⅓W	–	326 272 2502
R106	97K6	0 1	⅛W	50	329 000 9528
R107	97K6	0 1	⅛W	50	329 000 9528
R108	48K7	0 1	⅛W	50	329 000 9529
R109	200K	0 1	⅛W	50	329 000 9470
R110	3K3	0 5	⅛W	50	329 331 2102
R111	820	0 5	⅛W	50	329 820 2102
R112	22K	5	⅓W		326 223 2502
R113	3K3	5	⅓W	–	326 332 2501
R114	59K	0 5	⅛W	50	329 592 2501
R115	30K1	0 5	⅛W	50	329 303 2502
R116	62K	0 5	⅛W	50	329 623 2102
R117	22K	0.5	⅛W	50	329 223 2101
R120	100K	5	⅓W	–	326 104 2502
R121	100K	5	⅓W	–	326 104 2502
R122	3K9	5	⅓W		326 392 2501
R123	8K2	0 5	⅛W	50	329 820 2201
R124	250K	0 5	⅛W	50	329 000 9417

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (ppm)	Code No.
R125	10K	5	⅓W	–	326.103.2501
R126	10K	5	⅓W	–	326.103.2501
R127	4K7	0.5	⅛W	–	329.472.2102
R128	4K7	0.5	⅛W	50	329.472.2102
R129	2K2	0.5	⅛W	50	329.222.6503
R130	1K5	0.5	⅛W	50	329.152.2101
R131	560	0.5	⅛W	50	329.560.2101
R132	4K7	0.5	⅛W	50	329.472.2102
R133	200K	0.5	⅛W	50	329.000.9470
R134	120K	0.5	⅛W	50	329.124.2101
R135	2K7	5	⅓W	–	326.272.2502
R136	68K	0.5	⅛W	50	329.000.9476
R137	2M2	5	⅓W	–	326.225.2501
R138	1M	5	⅓W	–	326.105.2501
R139	180K	5	⅓W	–	326.180.2501
R140	27K	5	⅓W	–	326.273.2501
R141	10K	5	⅓W	–	326.103.2501
R142	68	5	⅓W	–	326.680.2501
R143	10K	5	⅓W	–	326.103.2501
R144	4K7	5	⅓W	–	326.472.2502
R145	4K7	0.5	⅛W	50	329.472.2102
R146	255R	0.5	–	50	329.250.1101
R147	4K7	0.5	–	50	329.472.2102
R148	2K2	0.5	–	50	329.222.6503
R149	22K	0.5	–	50	329.233.2101
R150	22K	0.5	–	50	329.223.2101
R151	10K	5	⅓W	–	326.103.2501
R152	1K	5	⅓W	–	326.102.2501
R153	3K9	5	⅓W	–	326.392.2501
R154	1K	5	⅓W	–	326.102.2501
R155	1K	5	⅓W	–	326.102.2501
R156	1K58	0.5	–	50	329.182.1101

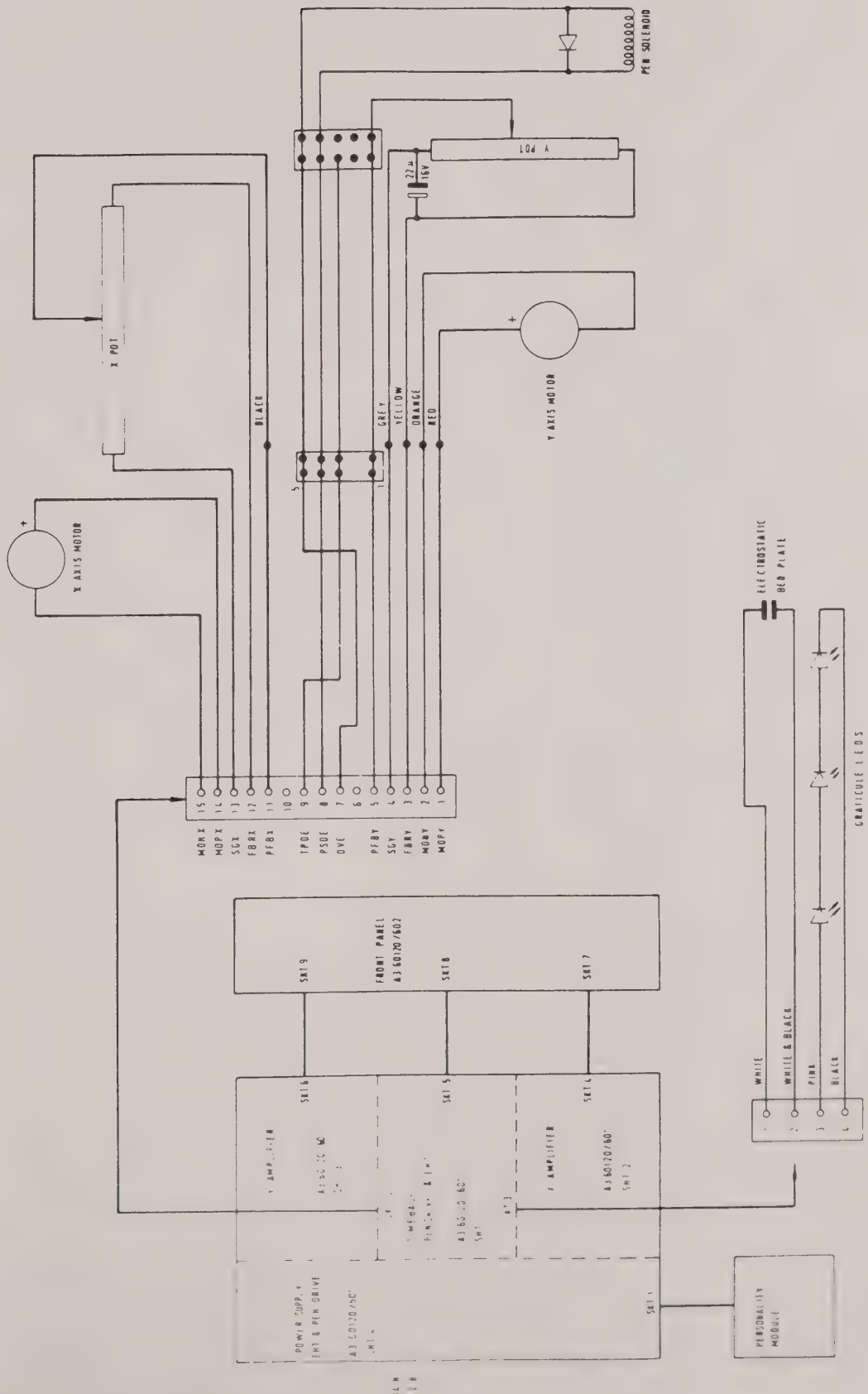
Capacitors

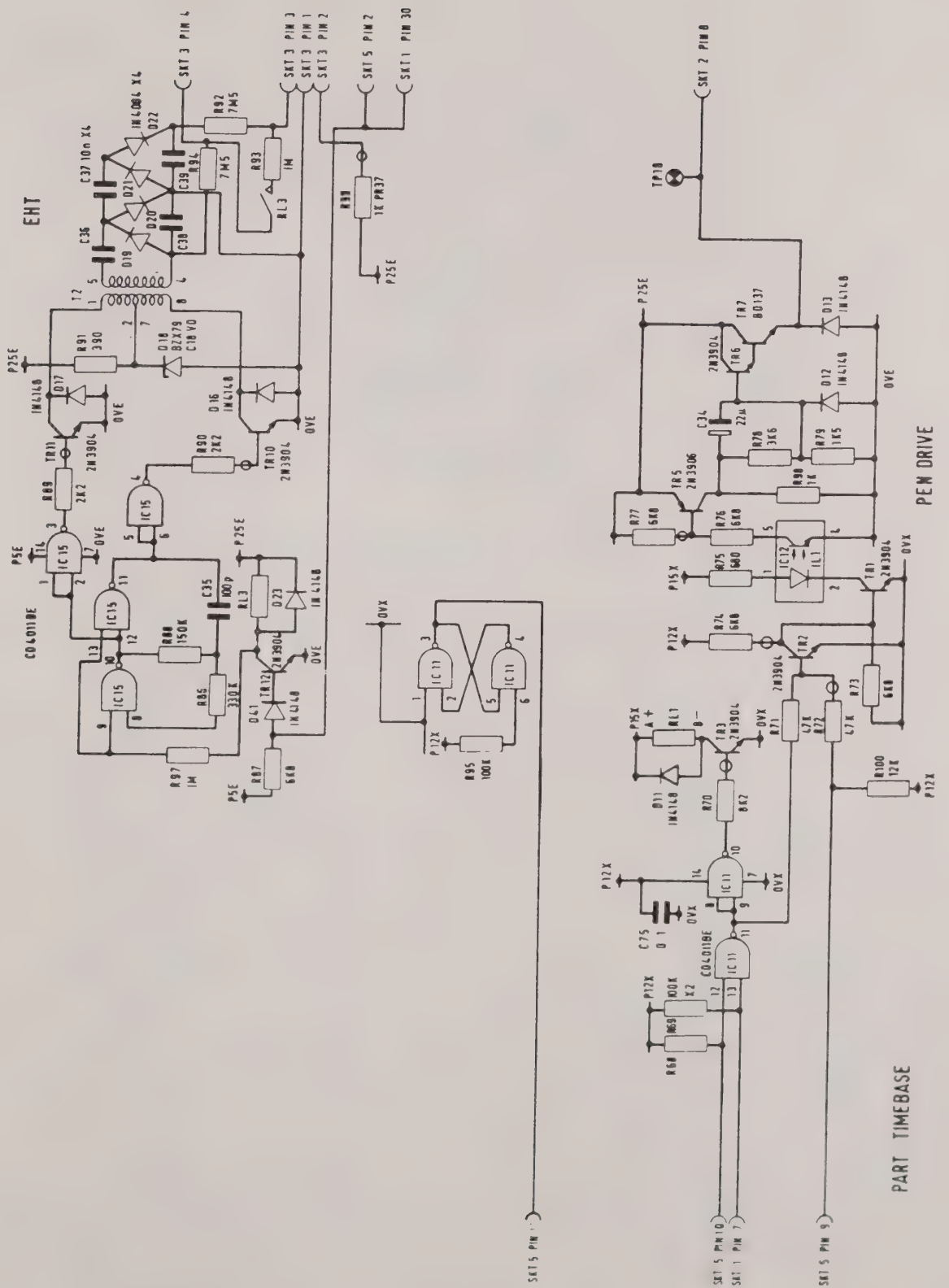
C1	2200µF	–	25V	–	313.201.3002
C2	2200µF	–	25V	–	313.201.3002
C3	2200µF	–	40V	–	313.201.3005
C4	2200µF	–	25V	–	313.201.3002
C5	2200µF	–	25V	–	313.201.3002
C6	0.15µF	–	250V	–	307.153.5502
C7	0.1µF	–	250V	–	313.104.3004
C8	0 1µF	–	250V	–	313.104 3004
C10	100PF	–	–	–	313.100 6322
C11	330PF	–	–	–	307.331.5001
C12	33nF	1	63V	–	306.222.5203
C13	33nF	1	63V	–	306.222.5203
C14	33nF	1	63V	–	306.222.5203
C15	33nF	1	63V	–	306.222.5203
C16	100PF	–	–	–	313.100.6322
C17	0.22µF	–	160V	–	306 224.5202
C18	10nF	–	250V	–	307.103.3001
C19	4µF	–	25V	–	320.405.2502
C20	22nF	–	250V	–	313.223.3001
C21	0.1µF	–	250V	–	313.104.3004
C22	0.1µF	–	250V	–	313.104.3004
C23	0.15µF	5	160V	–	306.154.5201
C25	0.1µF	–	250V	–	313.104.3004
C26	4nF	–	–	–	313.472.1002
C27	4µF	–	25V	–	320.405.2502
C28	0.1µF	–	250V	–	313.104 3004
C29	0 1µF	25V	–	320 405 2502	
C30	4µF	–	25V	–	320 405 2502
C34	22µF	–	25V	–	320.207 1002
C35	100PF	–	–	–	313 100 6322
C36	10nF	–	1KV	–	313.100 6330
C37	10nF	–	1KV	–	313 100 6330
C38	10nF	–	1KV	–	313 100 6330
C39	10nF	–	1KV	–	313 100 6330
C40	0 15	–	250V	–	307 153 5502
C41	0.1	–	250V	–	313.104.3004
C42	0.1	–	250V	–	313.104.3004
C44	100PF	–	–	–	313.100.6322
C45	330PF	–	–	–	307.331.5001
C46	33nF	1	63V	–	306.222.5203
C47	33nF	1	63V	–	306.222.5203
C48	33nF	1	63V	–	306.222.5203
C49	33nF	1	63V	–	306.222.5203
C50	100PF	–	–	–	313.100.6322
C51	0.22µF	–	160V	–	306.224.5202
C52	10nF	–	250V	–	307.103.3001
C53	4µ7	–	25V	–	320.405.2502
C54	15n	–	250V	–	307.153.5502
C55	0.1µ	–	250V	–	313.104.3004
C56	0.1µ	–	250V	–	313.104.3004
C57	0.15µ	–	160V	–	306.154.5201
C59	0.1µ	–	250V	–	313.104.3004
C60	47nF	–	–	–	313.472.1002
C61	4µ7	–	25V	–	320.405.2502
C62	0.1µ	–	250V	–	313.104.3004
C63	0.1µ	–	250V	–	313.104.3004
C64	4µ7	–	25V	–	320.405.2502
C65	2µ2	–	63V	–	320.255.0401
C66	0.1µ	–	250V	–	313.104.3004
C67	33PF	–	160V	–	306.300.5000
C68	0.047µF	–	250V	–	313.503.3002
C69	0.047µF	–	250V	–	313.503.3002
C70	2µ2	–	63V	–	320.255.0401
C71	33PF	–	160V	–	306.300.5000
C72	10nF	–	250V	–	307.103.3001
C75	0.1µF	–	250V	–	313.104.3004
C77	2µF	–	63V	–	320.255.0401
C78	2µF	–	63V	–	320.255.0401

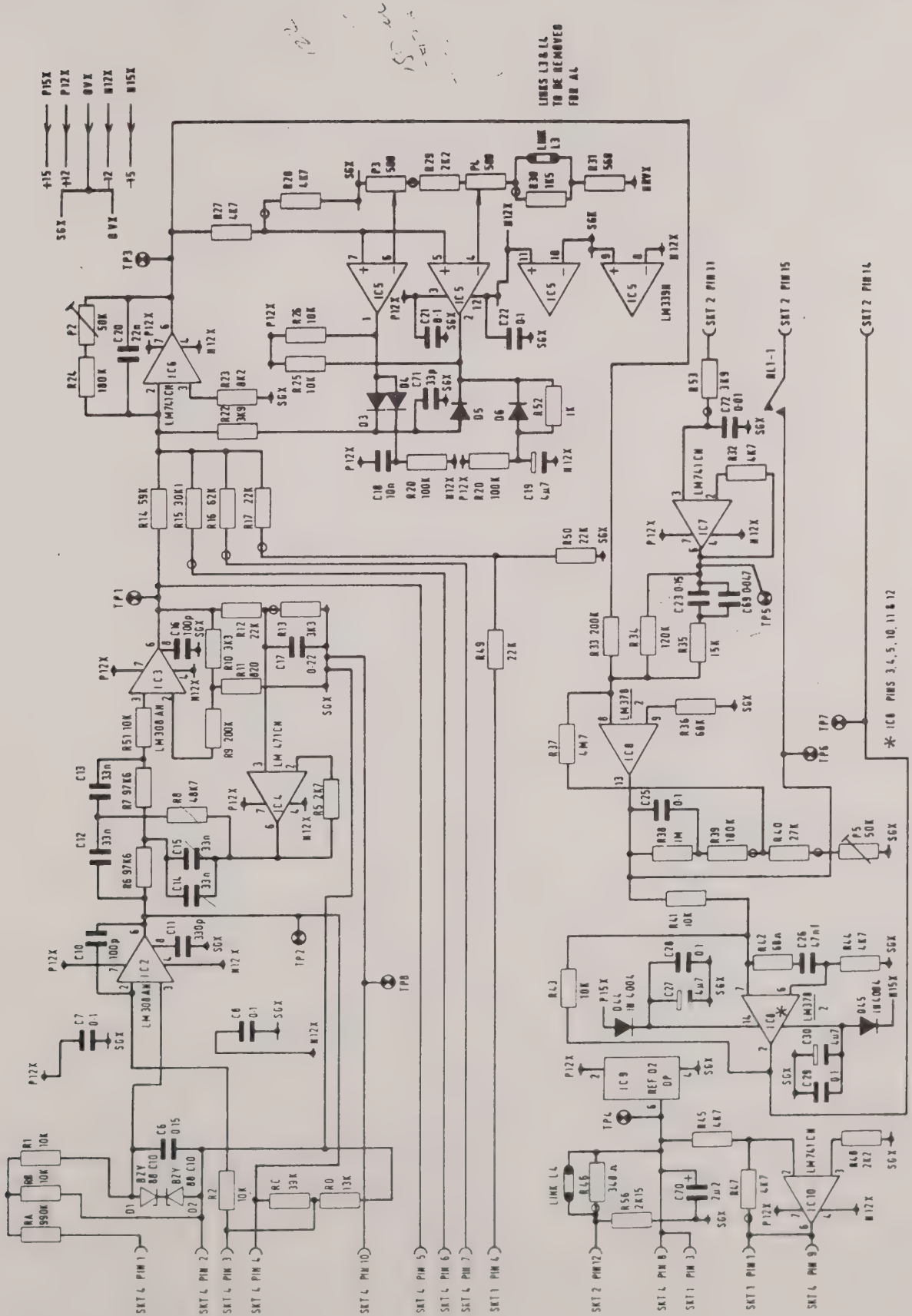
Diodes

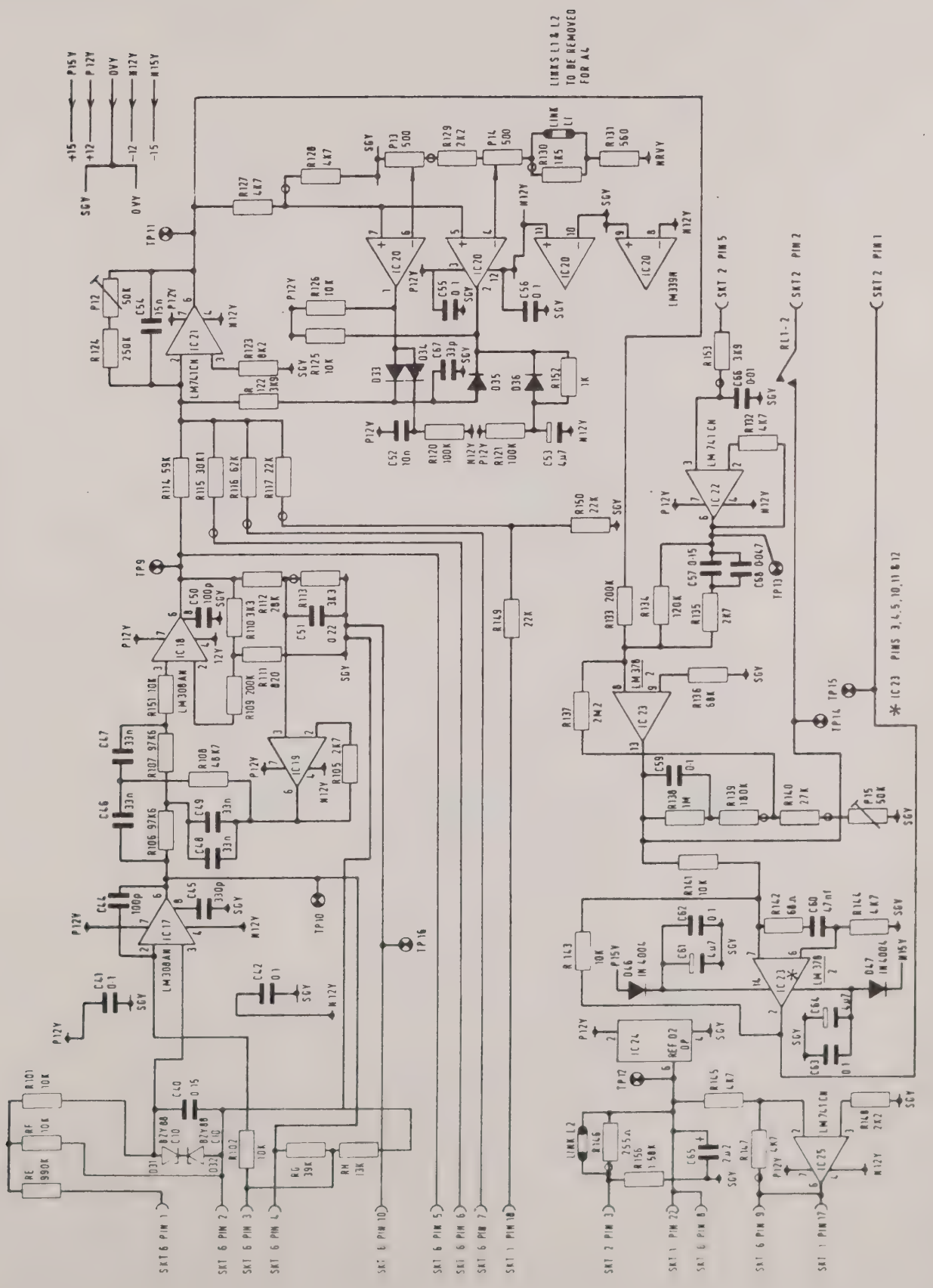
D1	BZY88	–	C10V0	–	336.008.0021
D2	BZY88	–	C10V0	–	336.008.0021
D3	IN4148	–	–	–	337.004.0017
D4	IN4148	–	–	–	337 004.0017
D5	IN4148	–	–	–	337.004 0017
D6	IN4148	–	–	–	337.004 0017
D7	IN4148	–	–	–	337.004 0017
D8	IN4148	–	–	–	337 004 0017
D11	IN4148	–	–	–	337.004.0017
D12	IN4148	–	–	–	337.004.0017
D13	IN4148	–	–	–	337.004 0017
D16	IN4148	–	–	–	337.004.0017
D17	IN4148	–	–	–	337.004.0017
D18	BZX79	–	C10V0	–	336.008 0007
D19	IN4004	–	–	–	336.004.0006
D20	IN4004	–	–	–	336.004 0006
D21	IN4004	–	–	–	336.004.0006
D22	IN4004	–	–	–	336.004.0006
D23	IN4148	–	–	–	337 004.0017
D31	BZY88	–	C10V0	–	336.008.0021
D32	BZY88	–	C10V0	–	336.008 0021
D33	IN4148	–	–	–	337 004.0017
D34	IN4148	–	–	–	337 004.0017
D35	IN4148	–	–	–	337 004 0017
D36	IN4148	–	–	–	337 004 0017
D37	IN4148	–	–	–	337 004 0017
D38	IN4148	–	–	–	337 004 0017
D41	IN4148	–	–	–	337 004 0017
D44	IN4004	–	–	–	336 004 0006
D45	IN4004	–	–	–	336 004 0006
D46	IN4004	–	–	–	336 004 0006
D47	IN4004	–	–	–	336 004 0006

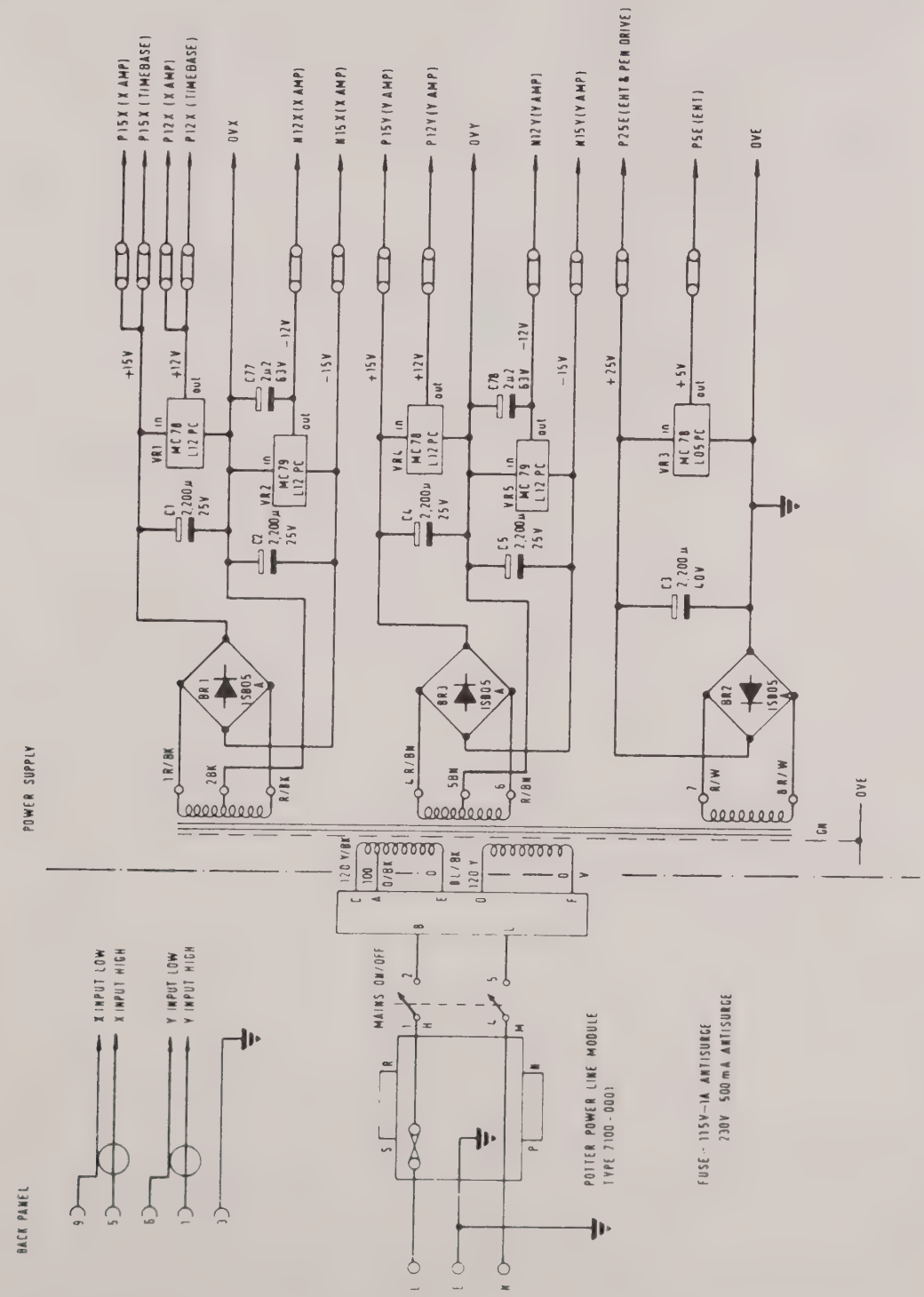
Component		Code No.
Transistors		
TR1	2N3904	337.006.0018
TR2	2N3904	337 006.0018
TR3	2N3904	337.006.0018
TR5	2N3906	337 006.0002
TR6	2N3904	337 006 0018
TR7	BD137	337.005.0014
TR10	2N3904	337.006.0018
TR11	2N3904	337.006.0018
TR12	2N3904	337 006.0018
Variable Resistors		
VR1	MC78L12CP	351 091 0019
VR2	MC79L12CP	351 091 0130
VR3	MC78L05CP	351 091 0131
VR4	MC78L12CP	351 091 0119
VR5	MC79L12CP	351 091 0130
Bridge Rectifiers		
BR1	IR TYPE ISB 05A	338 000 0024
BR2	IR TYPE ISB 05A	338 000 0024
BR3	IR TYPE ISB 05A	338 000 0024
Integrated Circuits		
IC1	LM321H	351 091 0012
IC2	LM308AN	351 091 0056
IC3	LM308AN	351 091 0056
IC4	LM741CN	351 091 0068
IC5	LM339N	351 091 0086
IC6	LM741CN	351 091 0068
IC7	LM741CN	351 091 0068
IC8	LM378N	351 091 0128
IC9	REF 02DP	351 091 0129
IC10	LM 741CN	351 091 0068
IC11	4011 BE	351 091 0125
IC12	IL1	351 091 0106
IC15	IC4011BE	351 091 0125
IC17	LM308AN	351 091 0056
IC18	LM308AN	351 091 0056
IC19	LM741CN	351 091 0068
IC20	LM339N	351 091 0086
IC21	LM741CN	351 091 0068
IC22	LM741CN	351 091 0068
IC23	LM378N	351 091 0128
IC24	REF 02DP	351 091 0129
IC25	LM741CN	351 091 0068
Potentionometers		
P1	5K	331 503.1266
P2	50K	331 503.1264
P3	500K	331 503.1269
P4	500K	331 503 1269
P5	50K	331.503 1264
P12	50K	331 503.1264
P13	500	331 503 1269
P14	500	331 503 1269
P15	50K	331 503 1264
Relays		
RL1	PMP2-2A-12V-680R	364 200 0056
RL3	ED-13704/A	364 200 0057
Connectors		
AMP TYPE	825433	421 404 6040
MINI SHUNT AMP TYPE	141767-1	421 404 6039

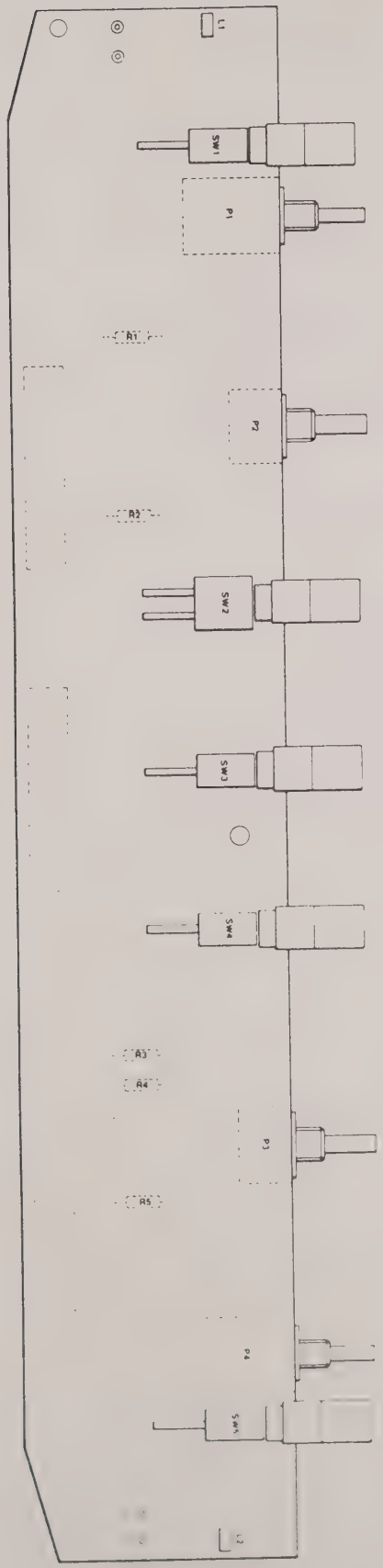

PCB SOLENOID
Y POT
22µ 16V
X POT
BLACK
GREY
YELLOW
ORANGE
RED
X AXIS MOTOR
Y AXIS MOTOR
MDRX
MDPX
SGX
FBRX
PFBX
TPDE
PSDE
OVE
PFBY
SGY
FBRY
MDRY
MDPY
ELECTROSTATIC BEAM PLATE
GRATICULE LEADS
WHITE
WHITE & BLACK
PINK
BLACK
SK19
FRONT PANEL A3 60120/602
SK18
SK17
SK16
SK15
SK14
SK1
POWER SUPPLY EHT & PCB DRIVE
PERSONALITY MODULE


EHT
PEN DRIVE
PART TIMEBASE
P25E
OVE
OVX
P12X
P15X
P5X
P5E
SKT 3 PIN 4
SKT 3 PIN 3
SKT 3 PIN 1
SKT 3 PIN 2
SKT 5 PIN 2
SKT 1 PIN 30
SKT 2 PIN 8
SKT 5 PIN 1
SKT 5 PIN 10
SKT 1 PIN 7
SKT 5 PIN 9
TP10
R92 7M5
R93 1M
R94 7M5
R91 390
R90 2K2
R89 2K2
R88 150K
R85 330K
R87 1M
R97 1M
R95 100K
R96 100K
R69 100K
R68
R70 8K2
R71 47K
R72 47K
R73 680
R74 680
R75 680
R76 680
R77 680
R78 3K6
R79 1K5
R80 1K
R100 12K
C35 100p
C34 22µ
C75 0.1
C36
C37 10n X4
C38
C39
C30
D16 IN4148
D17 IN4148
D18 BZX79 C18 V0
D19
D20
D21
D22
D23
D41 IN4148
D11 IN4148
D12 IN4148
D13 IN4148
TR11 2N3904
TR10 2N3904
TR1 2N3904
TR2 2N3904
TR3 2N3904
TR5 2N3906
TR6 2N3904
TR7 BD137
RL3
RL1
IC15 CD4011BE
IC11 CD4011BE
IC12 IL1
IC1
P25E
P12X
P15X
P5X
P5E
OVE
OVX

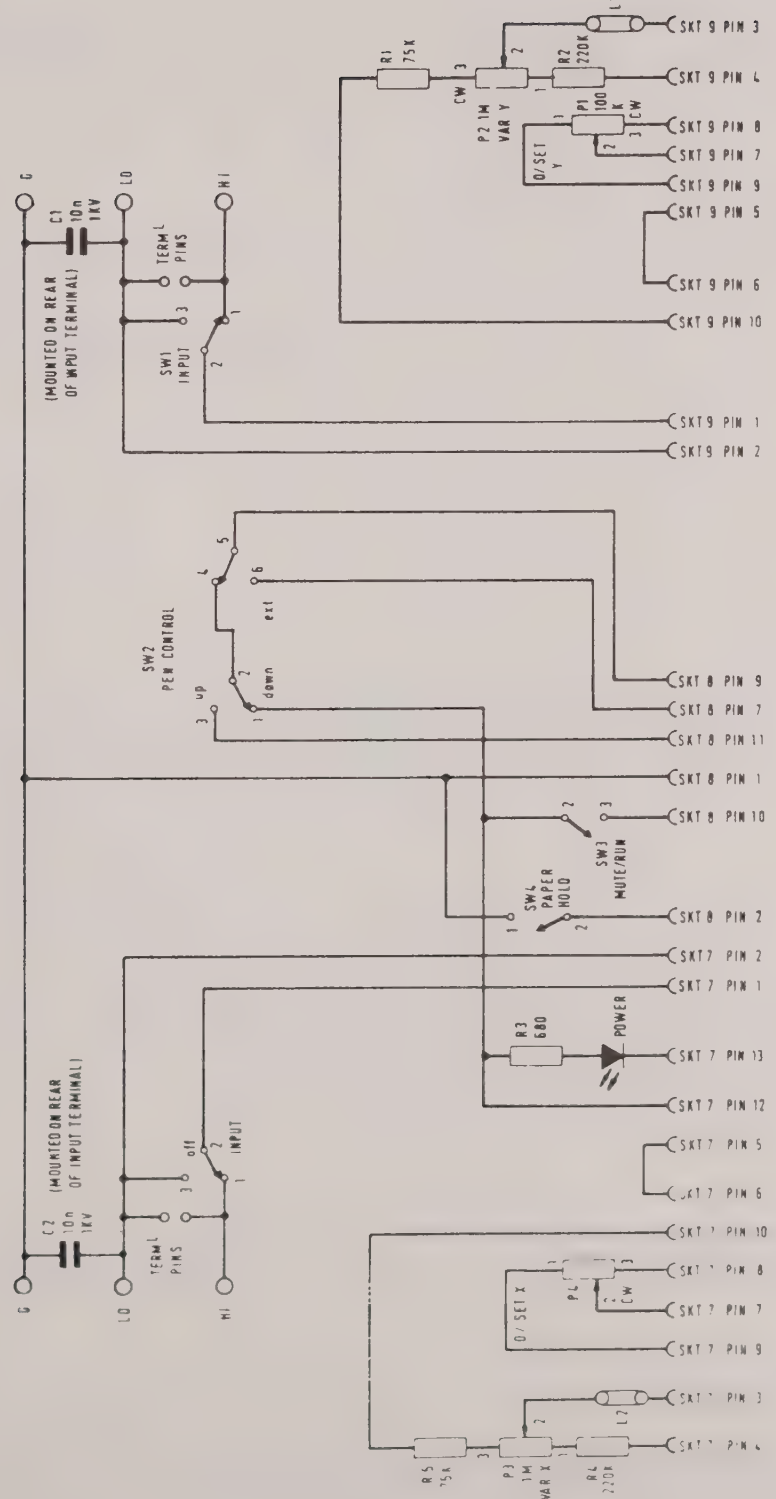





POWER SUPPLY
BACK PANEL
P15X (X AMP)
P15X (TIMEBASE)
P12X (X AMP)
P12X (TIMEBASE)
0VX
N12X (X AMP)
N15X (X AMP)
P15Y (Y AMP)
P12Y (Y AMP)
0VY
N12Y (Y AMP)
N15Y (Y AMP)
P25E (ENT & PEN DRIVE)
P5E (ENT)
0VE
GN
+15V
-15V
+12V
-12V
+75V
+5V
VR1
VR2
VR3
VR4
VR5
MC 78 L12 PC
MC 79 L12 PC
MC 78 L05PC
C1
C2
C3
C4
C5
C77
C78
2,200µ 25V
2µ2 63V
2,200 µ 40V
BR1
BR2
BR3
ISOS5
1R/BK
28K
R/BK
4 R/BN
5BN
6
R/BN
7
R/W
8 R/W
120 V/BK
100
0/BK
BL/BK
120 V
MAINS ON/OFF
POTTER POWER LINE MODULE
TYPE 7100-0001
FUSE - 115V-1A ANTISURGE
230V 500mA ANTISURGE
X INPUT LOW
X INPUT HIGH
Y INPUT LOW
Y INPUT HIGH



Item No./ Component	Description	Code No.	Qty
1	Front Panel PCB	60120/501	1
2	Connector	421.404.6030	3
3	P.C.B. Pins	713.005.0005	4
4	Connector	421.404.6040	2
5	Mini Shunt Connector	421.404.6039	2
R1	75kΩ ± 0.5% 50 PPM	329.753.2202	
R2	220kΩ ± 0.5% 50 PPM	329.224.2202	
R3	680Ω ± 5% C.F.	326.681.2501	
R4	220kΩ ± 0.5% 50 PPM	329.224.2202	
R5	75kΩ ± 0.5% 50 PPM	329.753.2202	
SW1	1 Pole c/o	355.019.0035	
SW2	2 Pole c/o 3 PSN	355.019.0036	
SW3	1 Pole c/o	355.019.0035	
SW4	1 Pole c/o	355.019.0035	
SW5	1 Pole c/o	355.019.0035	
P1	10 Turn 100k	331.104.4325	
P2	1 Turn 1M	331.105.0125	
P3	1 Turn 1M	331.105.0125	
P4	10 Turn 100k	331.104.4325	


G
C1 10n 1KV
(MOUNTED ON REAR OF INPUT TERMINAL)
LO
HI
TERM'L PINS
SW1 INPUT
R1 75K
P2 1M VAR Y
R2 220K
L1
P1 100K
O/SET Y
CW
SKT 9 PIN 3
SKT 9 PIN 4
SKT 9 PIN 8
SKT 9 PIN 7
SKT 9 PIN 9
SKT 9 PIN 5
SKT 9 PIN 6
SKT 9 PIN 10
SKT 9 PIN 1
SKT 9 PIN 2
SW2 PEN CONTROL
up
down
ext
SKT 8 PIN 9
SKT 8 PIN 7
SKT 8 PIN 11
SKT 8 PIN 1
SKT 8 PIN 10
SW3 MUTE/RUN
SW4 PAPER HOLD
SKT 8 PIN 2
SKT 7 PIN 2
SKT 7 PIN 1
R3 680
POWER
SKT 7 PIN 13
SKT 7 PIN 12
SKT 7 PIN 5
SKT 7 PIN 6
C2 10n 1KV
(MOUNTED ON REAR OF INPUT TERMINAL)
off
INPUT
SKT 7 PIN 10
SKT 7 PIN 8
SKT 7 PIN 7
SKT 7 PIN 9
O/SET X
SKT 7 PIN 3
SKT 7 PIN 4
L2
R5 75K
P3 1M VAR X
R4 220K

Willow Lane, Mitcham, Surrey CR4 4UL
Telephone 01-640 3490 Telex 946097

GOULD Bryans

Section 3:3
A3 and A4 OEM

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **OEM VERSION**

Information contained in this section

Circuit diagrams and component lists for all electronics relevant to the 60000 A3 and A4 OEM unit.

General information

Power Supply

A toroidal mains transformer is used with three separate secondary windings each having an integrated bridge rectifier and either one or two integrated regenerators associated with it. Ten voltage levels are generated, referred to three ground levels. X axis amplifiers and timebase use ±16v unregulated and ± 12v regulated supplies referred to 0v X. Y axis amplifiers use ±16v unregulated and ± 12v regulated supplies referred to 0v Y. The control and drive circuitry for electrostatic hold-down, pen solenoid and logic and switching functions use +25v unregulated and +5v regulated supplies.

X and Y signal and servo amplifiers

Input signals to the recorder are attenuated by the sensitivity control circuitry on the instrument front panel, this attenuated signal is applied to the signal amplifiers on the main p.c.b.

The first of these is a pre-amp, op-amp combination, the gain of which is set by the sensitivity controls on the front panel. The second stage of amplification incorporates an active notch filter at the line frequency. At the next stage, offset, variable sensitivity, external offset and variable timebase (X only) are summed with the input signal – and the electronic limit control signal is applied.

The output from this stage is then summed with the position feedback signal at the input of the servo amplifier. This final stage consists of two power op-amps connected in a bridge circuit supplying drive to the servo motors which move the gantry and pen carriage.

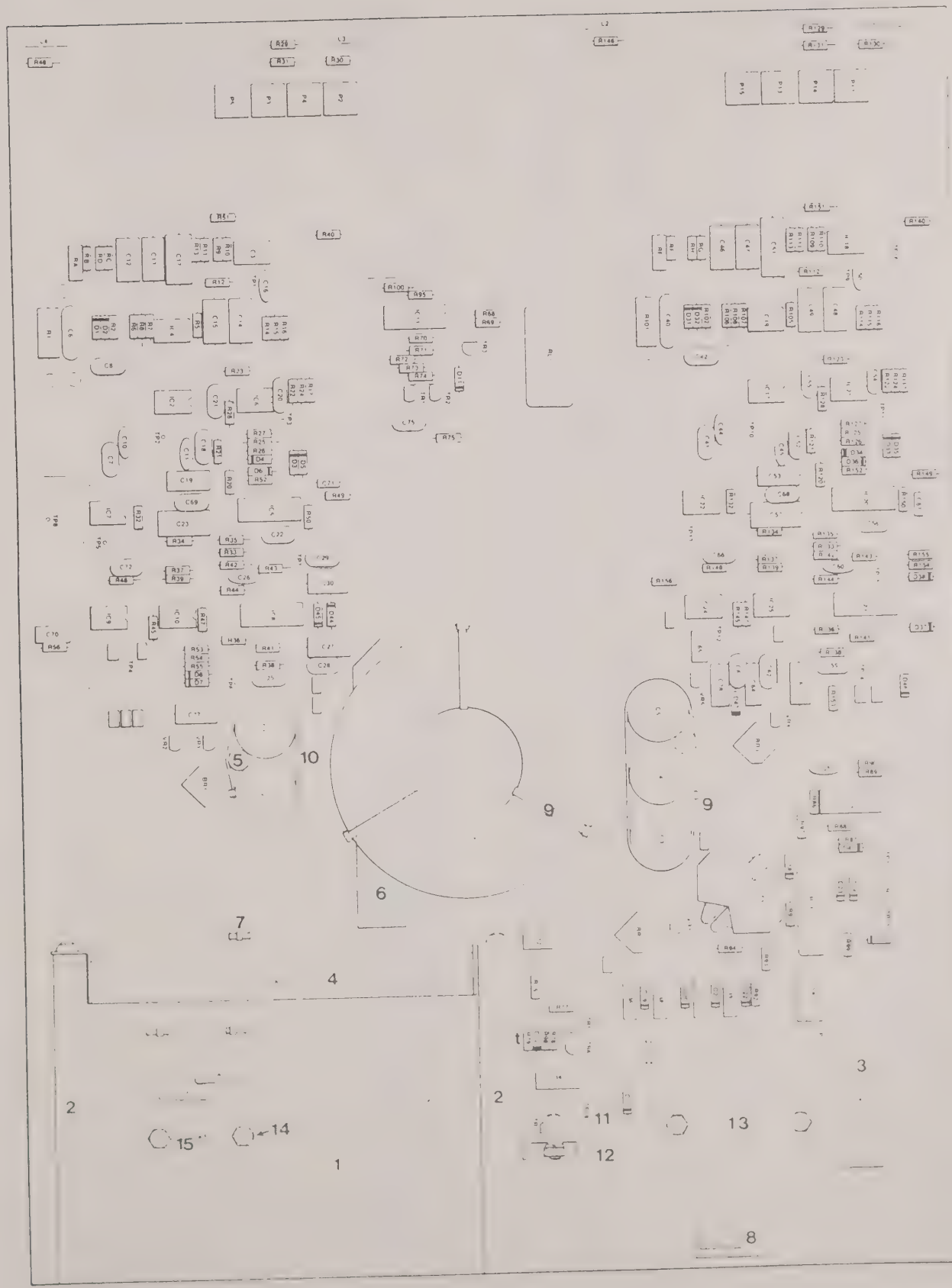
Timebase

An integrator is used to generate a linear ramp which is fed into the third stage of the X amplifier chain. Input current to the integrator is controlled over two decades by the s/cm switch on the front panel. The front panel variable control reduces the feedrate selected by attenuating the signal fed to the X amplifier chain.

Controls etc.

Eht for electrostatic hold-down is provided by an oscillator driving a step-up transformer into a voltage quadrupler. The resulting output of approx. 1Kv is applied to the bed-plate.

The pen is controlled by the timebase circuit and the front panel switch, the control signal being opto-coupled to the earth referenced drive circuit. The pen down command initially applies a high voltage to the pen solenoid this voltage decaying to a lower holding level.


1
2
3
4
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12
13
14
15

Component	Description	Code No.	Qty
1	Main PCB	60000/502	1
2	Personality PCB Guide	60000/544	2
3	Film Wire Connector	60000/69	1
4	Personality Module Connector	60000/587	1
T1	Power Supply Transformer	60000/560	1
T2	Paper Hold Transformer	50000/57	1
5	Capacitor Support	60000/584	2
6	Scotch Electrical Tape	485.002 0317	A/R
7	Ty-Rap Ty23M	718.700 1001	14
–	Screw M3 × 6 Pozi Pan	–	6
–	Nut M3 Square	–	4
–	Screw M3 × 6 Pozi Pan Taptite	–	2
–	Screw M3 × 20 Pozi Pan		2
8	Cable Clip	718 100 0119	1
9	Ty-Rap Ty 525M	718.700 1004	4
10	Ty-Rap Ty 24M	718 700 1002	1
11	PCB Pins	713 005.0005	28
Skt 3	4 Way Connector	421 614 7041	1
12	Heatsink	415 100 0003	1
–	Screw M3 × 10 Pozi Pan	–	1
–	Nut M3 Hex	–	3
–	Washer M3 Single Coil	–	9
13	Terminal Block	431 012.0016	1
–	Tinned Copper Wire	699 099 0072	A/R
–	Wire – Black	450.101 1436	A/R
14	Spacer	750 002 0251	2
15	Socket	421 805.3001	1
–	Screw M3 x 20 Pozi Pan	–	2
–	Sleeve 1mm – Black	441 000 0019	A/R
–	Single Core Screened Filotex	450 013 0203	A/R

Resistors

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (PPM)	Code No.
RA	990K	0.1	1/4W	50	329 000 9520
RB	10K	0.1	1/8W	50	329 000 9408
RC	39K	0.1	1/8W	50	329 000 9525
RD	13K	0.1	1/8W	50	329 000 9526
RE	990K	0.1	1/4W	50	329 000 9520
RF	10K	0.1	1/8W	50	329 000 9408
RG	39K	0.1	1/8W	50	329 000 9525
RH	13K	0.1	1/8W	50	329 000 9526
R1	10K	5	2.5W	–	329 104 2202
R2	10K	0.1	1/8W	50	329 000 9408
R5	2K7	5	1/3W	–	326.272 2502
R6	97K6	0.1	1/8W	50	329 000 9528
R7	97K6	0.1	1/8W	50	329 000 9528
R8	48K7	0.1	1/8W	50	329 000 9529
R9	200K	0.1	1/8W	50	329 000 9470
R10	3K3	0.5	1/8W	50	329 331 2102
R11	820	0.5	1/8W	50	329 820 2102
R12	22K	5	1/3W	–	326 223 2502
R13	3K3	5	1/3W	–	326 332 2501
R14	59K	0.5	1/8W	50	329 592 2501
R15	30K1	0.5	1/8W	50	329 303 2502
R16	62K	0.5	1/8W	50	329 623 2102
R17	22K	0.5	1/8W	50	329 223 2101
R20	100K	5	1/3W	–	326 104 2502
R21	100K	5	1/3W	–	326 104 2502
R22	3K9	5	1/3W	–	326 392 2501
R23	8K2	0.5	1/8W	50	329 820 2201
R24	180K	0.5	1/8W	50	329 186 2102
R25	10K	5	1/3W	–	326 103 2501
R26	10K	5	1/3W	–	326 103 2501
R27	4K7	0.5	1/8W	50	329 473 2102
R28	4K7	0.5	1/8W	50	329 473 2102
R29	2K2	0.5	1/8W	50	329 222 6503
R30	1K5	0.5	1/8W	50	329 152 2101
R31	560	0.5	1/8W	50	329 560 2101
R32	4K7	0.5	1/8W	50	329 473 2102
R33	200K	0.5	1/8W	50	329 00 9470
R34	120K	0.5	1/8W	50	329 124 2101
R35	15K	5	1/3W	–	326 153 2502
R36	68K	0.5	1/8W	50	329 000 9476
R37	4M7	5	1/3W	–	326 475 2501
R38	1M	5	1/3W	–	326 105 2501
R39	180K	5	1/3W	–	326 180 2501
R40	27K	5	1/3W	–	326 273 2501
R41	10K	5	1/3W	–	326 103 2501
R42	68	5	1/3W	–	326 680 2501
R43	10K	5	1/3W	–	326 103 2501
R44	4K	5	1/3W	–	326 472 2502
R45	4K7	0.5	1/8W	50	329 472 2102
R46	348	0.5	1/8W	50	329 340 1101
R47	4K7	0.5	1/8W	50	329 472 2102
R48	2K2	0.5	1/8W	50	329 222 6503
R49	22K	0.5	1/8W	50	329 223 2101
R50	22K	0.5	1/8W	50	329 223 2101
R51	10K	5	1/3W	–	326 103 2501
R52	1K	5	1/3W	–	326 102 2501
R53	3K9	5	1/3W	–	326 392 2501
R54	1K	5	1/3W	–	326 102 2501
R55	1K	5	1/3W	–	326 102 2501
R56	2K15	0.5	1/8W	50	329 212 1101
R68	100K	5	1/3W	–	326.104 2502
R69	100K	5	1/3W	–	326 104 2502
R70	8K2	5	1/3W	–	326 822 2501
R71	47K	5	1/3W	–	326 473 2502
R72	47K	5	1/3W	–	326 473 2502
R73	6K8	5	1/3W	–	326 682 2501
R74	6K8	5	1/3W	–	326 682 2501
R75	680	5	1/3W	–	326 681 2501
R76	6K8	5	1/3W	–	326 682 2501
R77	6K8	5	1/3W	–	326 682 2501
R78	3K6	5	1/3W	–	326 362 2501
R79	1K5	5	1/3W	–	326 152 2501
R86	33K	5	1/3W	–	326 334 2501
R87	6K8	5	1/3W	–	326 682 2501
R88	150K	5	1/3W	–	326 154 2501
R89	2K2	5	1/3W	–	326 222 2502
R90	2K2	5	1/3W	–	326 222 2502
R91	390	5	1/3W		
R92	7M5	5	1/3W	–	329 705 2101
R93	1M	5	1/3W	–	326 105 2501
R94	7M5	5	1/3W	–	329 705 2101
R95	100K	5	1/3W	–	326 104 2502
R97	1M	5	1/3W	–	326 105 2501
R98	1K	5	1/3W		326 102 2501
R99	820	5	1/3W	–	329 821 2101
R100	12K	5	1/3W		326 123 2501
R101	10K	5	2.5W		329 104 2202
R102	10K	0.1	1/8W	50	329 000 9408
R105	2K7	5	1/3W	–	326 272 2502
R106	97K6	0.1	1/8W	50	329 000 9528
R107	97K6	0.1	1/8W	50	329 000 9528
R108	48K7	0.1	1/8W	50	329 000 9529
R109	200K	0.1	1/8W	50	329 000 9470
R110	3K3	0.5	1/8W	50	329 331 2102
R111	820	0.5	1/8W	50	329 820 2102
R112	22K	5	1/3W	–	326 223 2502
R113	3K3	5	1/3W	–	326 332 2501
R114	59K	0.5	1/8W	50	329 592 2501
R115	30K1	0.5	1/8W	50	329 303 2502
R116	62K	0.5	1/8W	50	329 623 2102
R117	22K	0.5	1/8W	50	329 223 2101

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (ppm)	Code No.
R120	100K	5	1/3W	–	326 104.2502
R121	100K	5	1/3W	–	326.104.2502
R122	3K9	5	1/3W	–	326.392.2501
R123	8K2	0.5	1/8W	50	329.820.2201
R124	250K	0.5	1/8W	50	329 000.9417
R125	10K	5	1/3W	–	326.103.2501
R126	10K	5	1/3W	–	326.103.2501
R127	4K7	0.5	1/8W	–	329.472.2102
R128	4K7	0.5	1/8W	50	329.472.2102
R129	2K2	0.5	1/8W	50	329 222.6503
R130	1K5	0.5	1/8W	50	329 152.2101
R131	560	0.5	1/8W	50	329.560.2101
R132	4K7	0.5	1/8W	50	329.472.2102
R133	200K	0.5	1/8W	50	329.000.9470
R134	120K	0.5	1/8W	50	329 124 2101
R135	2K7	5	1/3W	–	326.272.2502
R136	68K	0.5	1/8W	50	329.000.9476
R137	2M2	5	1/3W	–	326.225.2501
R138	1M	5	1/3W	–	326 105.2501
R139	180K	5	1/3W	–	326 180.2501
R140	27K	5	1/3W	–	326.273.2501
R141	10K	5	1/3W	–	326 103.2501
R142	68	5	1/3W	–	326 680 2501
R143	10K	5	1/3W	–	326 103.2501
R144	4K7	5	1/3W	–	326 472.2502
R145	4K7	0 5	1/8W	50	329 472 2102
R146	255R	0 5		50	329 250 1101
R147	4K7	0 5		50	329 472 2102
R148	2K2	0 5		50	329 222 6503
R149	22K	0 5		50	329 233 2101
R150	22K	0 5		50	329 223 2101
R151	10K	5	1/3W	–	326 103 2501
R152	1K	5	1/3W		326 102 2501
R153	3K9	5	1/3W		326 392 2501
R154	1K	5	1/3W	–	326 102 2501
R155	1K	5	1/3W	–	326 102 2501
R156	1K58	0.5		50	329 182 1101

Capacitors

C1	2200μF	–	25V		313 201 3002
C2	2200μF	–	25V	–	313 201 3002
C3	2200μF	–	40V		313 201 3005
C4	2200μF	–	25V		313 201 3002
C5	2200μF	–	25V		313 201 3002
C6	0 15μF	–	250V		307 153 5502
C7	0 1μF	–	250V		313 104 3004
C8	0 1μF		250V		313 104 3004
C10	100PF				313 100 6322
C11	330PF				307 331 5001
C12	33nF	1	63V		306 222 5203
C13	33nF	1	63V		306 222 5203
C14	33nF	1	63V		306 222 5203
C15	33nF	1	63V		306 222 5203
C16	100PF	–	–		313 100 6322
C17	0 22μF	–	160V		306 224 5202
C18	10nF	–	250V		307 103 3001
C19	4μF	–	25V		320 405 2502
C20	22nF	–	250V	–	313 223 3001
C21	0 1μF	–	250V		313 104 3004
C22	0 1μF	–	250V		313 104 3004
C23	0 15μF	5	160V		306 154 5201
C25	0 1μF	–	250V		313 104 3004
C26	4nF	–	–		313 472 1002
C27	4μF		25V		320 405 2502
C28	0 1μF		250V		313 104 3004
C29	0 1μF		25V		320 405 2502

Component	Value (Ω)	Tolerance (± %)	Rating	Temperature Coefficient (ppm)	Code No.
C30	4μF	–	25V	–	320 405.2502
C34	22μF	–	25V	–	320.207 1002
C35	100PF	–	–	–	313 100 6322
C36	10nF	–	1KV	–	313.100.6330
C37	10nF	–	1KV	–	313 100 6330
C38	10nF	–	1KV	–	313.100.6330
C39	10nF	–	1KV	–	313.100 6330
C40	0.15	–	250V	–	307.153.5502
C41	0.1	–	250V	–	313.104.3004
C42	0.1	–	250V	–	313.104.3004
C44	100PF	–	–	–	313.100 6322
C45	330PF	–	–	–	307 331 500
C46	33nF	1	63V	–	306.222.5203
C47	33nF	1	63V	–	306.222.5203
C48	33nF	1	63V	–	306 222 5203
C49	33nF	1	63V	–	306.222 5203
C50	100PF	–	–	–	313.100 6322
C51	0.22μF	–	160V	–	306.224 5202
C52	10nF	–	250V	–	307.103 3001
C53	4μ7	–	25V	–	320.405.2502
C54	15n	–	250V	–	307 153 5502
C55	0.1μ	–	250V	–	313.104 3004
C56	0.1μ	–	250V	–	313.104 3004
C57	0.15μ	–	160V	–	306 154 5201
C59	0.1μ	–	250V	–	313.104 3004
C60	47nF	–	–	–	313.472.1002
C61	4μ7	–	25V	–	320 405 2502
C62	0 1μ	–	250V	–	313.104 3004
C63	0.1μ	–	250V	–	313.104 3004
C64	4μ7	–	25V	–	320.405.2502
C65	2μ2	–	63V	–	320.255 0401
C66	0.1μ	–	250V	–	313 104 3004
C67	33PF	–	160V	–	306 300.5000
C68	0.047μF	–	250V	–	313 503 3002
C69	0.047μF	–	250V	–	313 503 3002
C70	2μ2	–	63V	–	320.255 0401
C71	33PF	–	160V	–	306 300 5000
C72	10nF	–	250V	–	307 103 3001
C75	0 1μF	–	250V	–	313 104 3004
C77	2μF	–	63V	–	320 255 0401
C78	2μF	–	63V	–	320.255 0401
C79	10nF	–	1 kV	–	313 100 6300
C80	10nF	–	1 kV	–	313 100 6330

Diodes

D1	BZY88	–	C10V0	–	336 008 0021
D2	BZY88	–	C10V0	–	336 008 0021
D3	IN4148	–	–	–	337 004 0017
D4	IN4148			–	337 004 0017
D5	IN4148	–		–	337 004 0017
D6	IN4148	–		–	337 004 0017
D7	IN4148	–	–	–	337 004 0017
D8	IN4148	–	–	–	337 004 0017
D11	IN4148	–	–	–	337 004 0017
D12	IN4148	–	–	–	337 004 0017
D13	IN4148	–	–	–	337 004 0017
D16	IN4148	–	–	–	337 004 0017
D17	IN4148	–	–	–	337 004 0017
D18	BZX79	–	C10V0	–	336 008 0007
D19	IN4004	–	–	–	336 004 0006
D20	IN4004	–	–	–	336 004 0006
D21	IN4004	–	–	–	336 004 0006
D22	IN4004	–	–	–	336 004 0006
D23	IN4148	–	–	–	337 004 0017
D31	BZY88	–	C10V0	–	336 008 0021
D32	BZY88	–	C10V0	–	336 008 0021

Component		Code No.
D33	IN4148	337.004.0017
D34	IN4148	337.004.0017
D35	IN4148	337.004.0017
D36	IN4148	337.004.0017
D37	IN4148	337.004.0017
D38	IN4148	337.004.0017
D41	IN4148	337.004.0017
D44	IN4004	336.004.0006
D45	IN4004	336.004.0006
D46	IN4004	336.004.0006
D47	IN4004	336.004.0006

Transistors

TR1	2N3904	337.006.0018
TR2	2N3904	337 006 0018
TR3	2N3904	337.006.0018
TR5	2N3906	337.006.0002
TR6	2N3904	337.006.0018
TR7	BD137	337 005 0014
TR10	2N3904	337.006.0018
TR11	2N3904	337.006 0018
TR12	2N3904	337 006.0018

Variable Resistors

VR1	MC78L12CP	351 091 0019
VR2	MC79L12CP	351 091 0130
VR3	MC78L05CP	351 091 0131
VR4	MC78L12CP	351 091 0119
VR5	MC79L12CP	351 091 0130

Bridge Rectifiers

BR1	IR TYPE ISB 05A	338 000 0024
BR2	IR TYPE ISB 05A	338 000 0024
BR3	IR TYPE ISB 05A	338 000 0024

Integrated Circuits

IC2	LM308AN	351 091.0056
IC3	LM308AN	351 091 0056
IC4	LM741CN	351 091 0068
IC5	LM339N	351 091 0086
IC6	LM741CN	351 091 0068
IC7	LM741CN	351 091 0068
IC8	LM378N	351 091.0128
IC9	REF 02DP	351 091 0129
IC10	LM 741CN	351 091 0068
IC11	4011 BE	351 091 0125
IC12	IL1	351 091 0106
IC15	IC4011BE	351 091 0125
IC17	LM308AN	351 091 0056
IC18	LM308AN	351 091 0056
IC19	LM741CN	351 091 0068
IC20	LM339N	351 091 0086
IC21	LM741CN	351 091 0068
IC22	LM741CN	351 091 0068
IC23	LM378N	351 091 0128
IC24	REF 02DP	351 091 0129
IC25	LM741CN	351 091 0068

Potentionometers

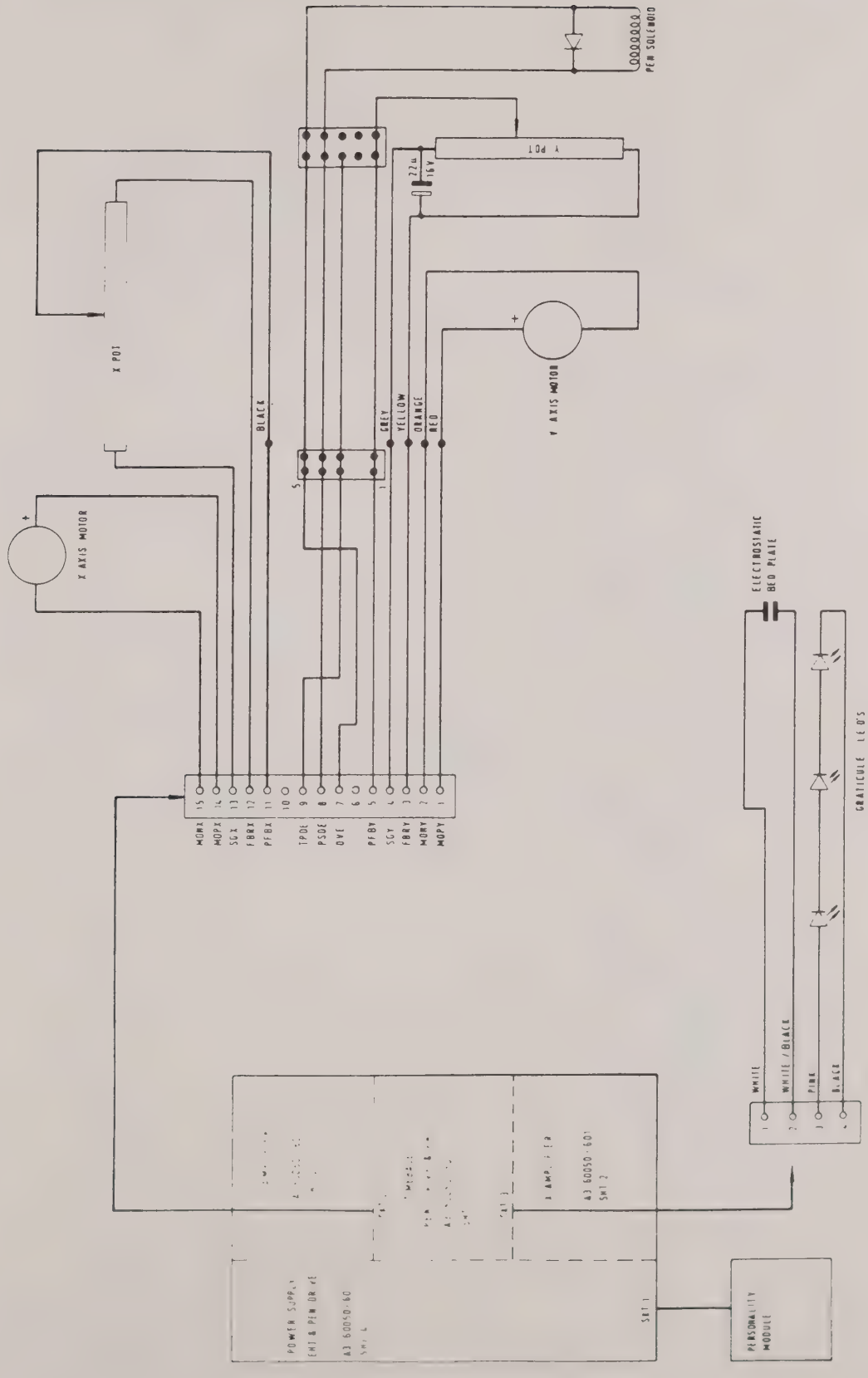
P1	5K	331 503 1266
P2	50K	331 503 1264
P3	500K	331 503 1269
P4	500K	331 503 1269
P5	50K	331 503 1264
P12	50K	331 503 1264
P13	500	331 503 1269
P14	500	331 503.1269
P15	50K	331.503.1264

Relays

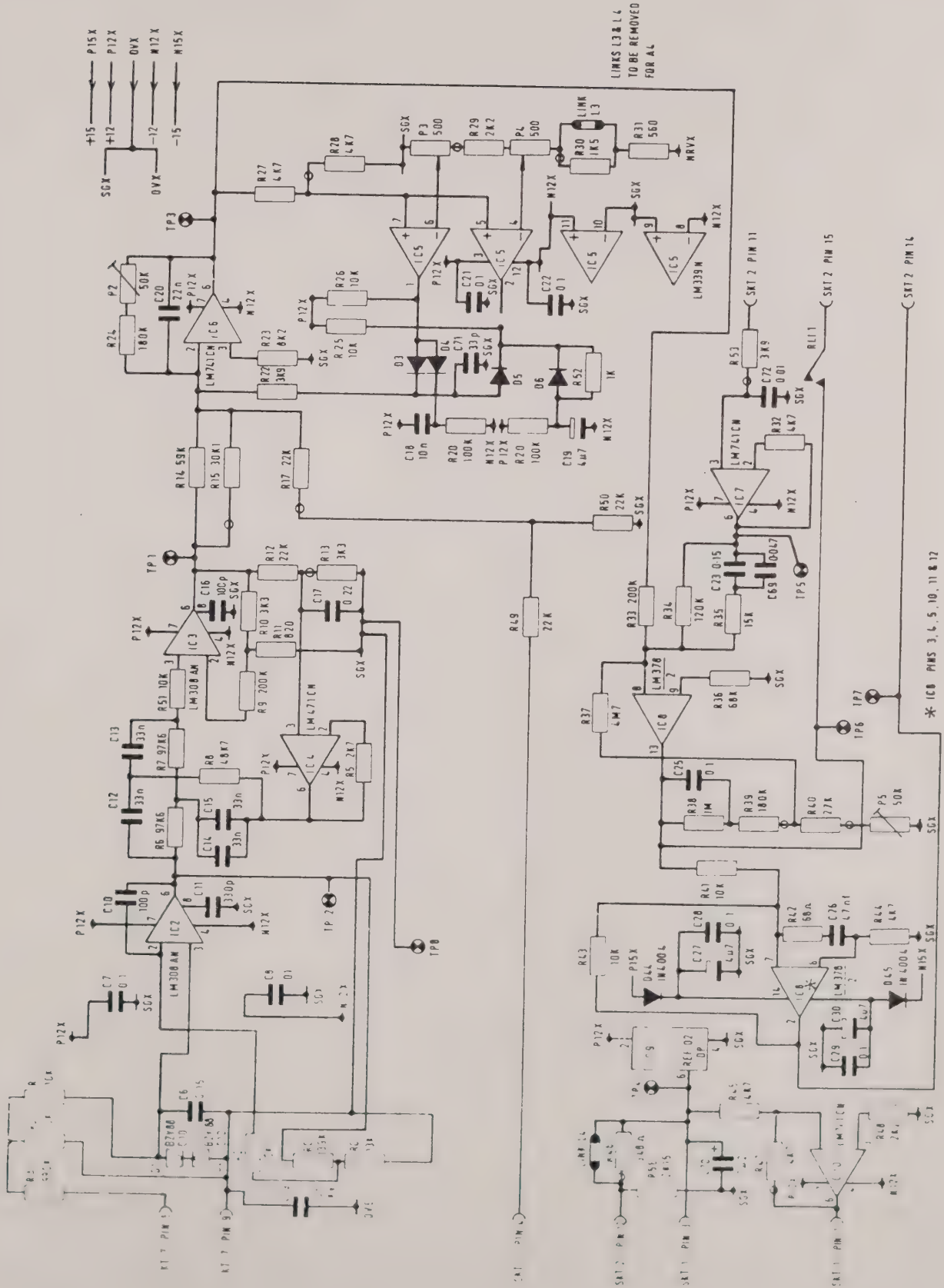
RL1	PMP2-2A-12V-680R	364.200 0056
RL3	ED-13704/A	364.200 0057

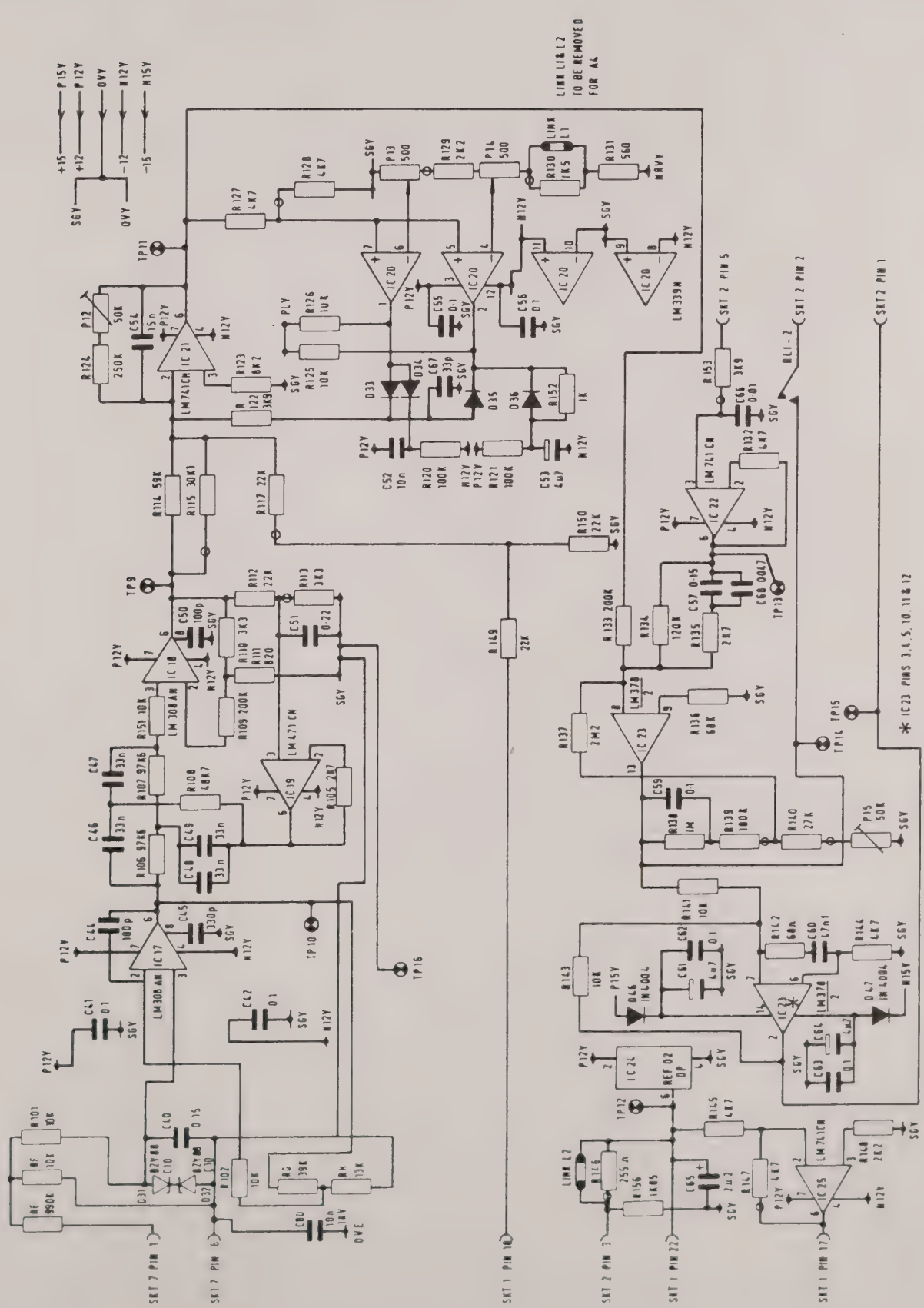
Connectors

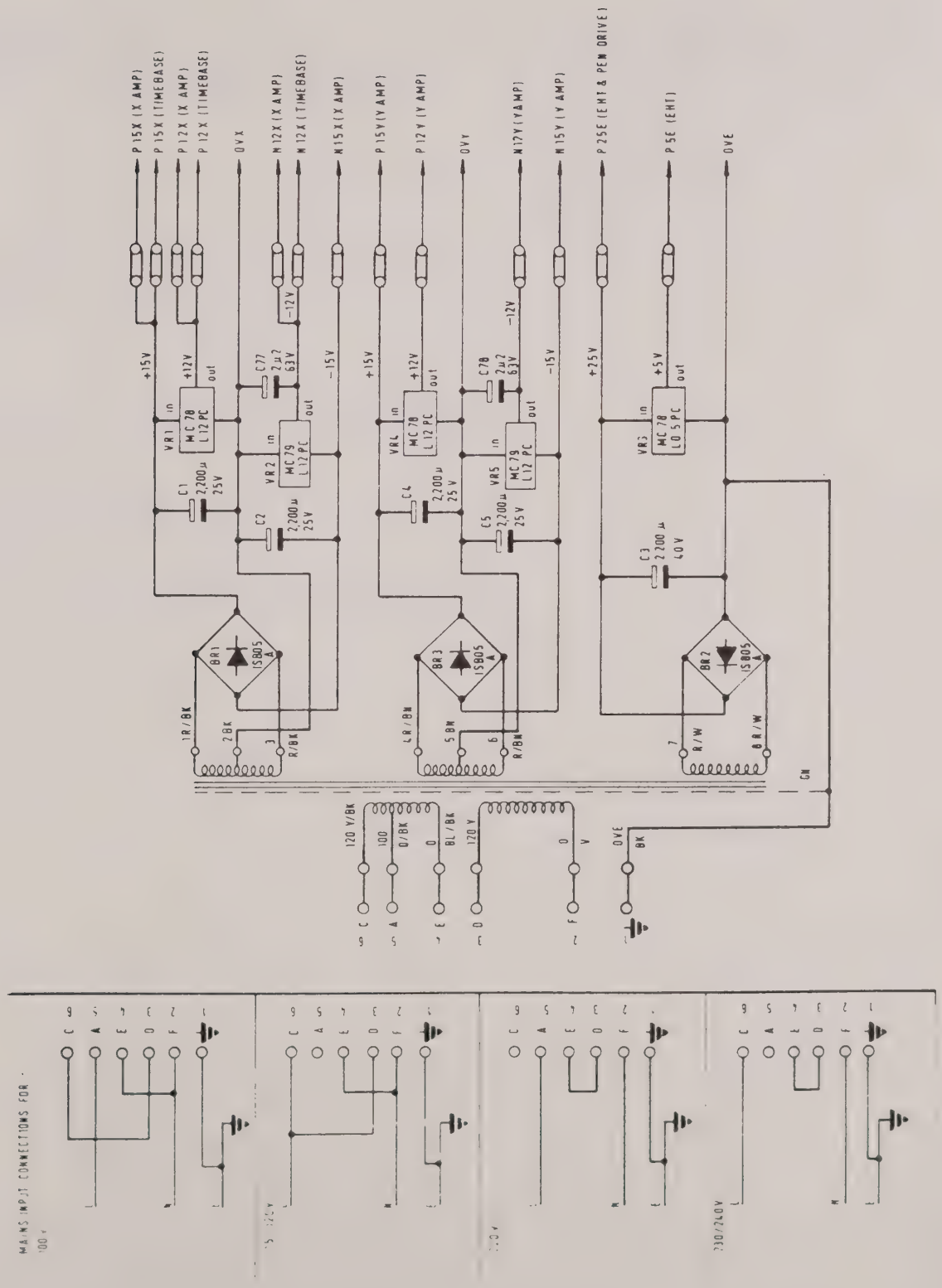
AMP TYPE	825433	421.404 6040
MINI SHUNT AMP TYPE	141767-1	421 404 6039


PEN SOLENOID
Y POT
22µ
16V
X POT
X AXIS MOTOR
Y AXIS MOTOR
BLACK
GREY
YELLOW
ORANGE
RED
MOMX
MOPX
SGX
FBRX
PFBX
TPOL
PSOL
OVF
PFBY
SGY
FBRY
MOMY
MOPY
ELECTROSTATIC BED PLATE
GRATICULE LEDS
WHITE
WHITE / BLACK
PINK
BLACK
POWER SUPPLY
EHT & PEN DRIVE
A3 60050-60
SHT 4
A AMP. PCB
A3 60050-601
SHT 2
PERSONALITY MODULE
MAIN PCB

EHT
PEN DRIVE
PART TIMEBASE
SKT 3 PIN 4
SKT 3 PIN 3
SKT 3 PIN 1
SKT 3 PIN 2
SKT 1 PIN 30
SKT 2 PIN 8
SKT 1 PIN 7
SKT 1 PIN 6
P25E
P15X
P12X
OVE
OVX
T2
C37 10n X4
C36
C39
C38
D18 BZX79 C18V0
D16
D17
D19
D20
D21
D22
D23
D11
D12
D13
D17
IN4004 X4
IN4148
R91 390
R92 7M5
R93 1M
R94 7M5
R99 1K PR37
R89 2K2
R90 2K2
R88 150K
R86 330K
R97 1M
R87 6K8
R95 100K
R96 100K X2
R98 1K
R100 12K
R70 8K2
R71 L7K
R72 L7K
R73 6K8
R74 6K8
R75 6K8
R76 6K8
R77 6K8
R78 3K6
R79 1K5
C35 100p
C34 22u
C75 0.1
TR1 2N3904
TR2 2N3904
TR3 2N3904
TR5 2N3906
TR6 2N3904
TR7 BD137
TR10 2N3904
TR11 2N3904
TR12 2N3904
RL1
RL3
IC11
IC12
IC15
CD4011BE
TP10


+15
+12
0VX
-12
-15
SGX
0VX
LINKS L3 & L4 TO BE REMOVED FOR AC
LINK L3
TP1
TP2
TP3
TP5
TP6
TP7
TP8
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
LM308AN
LM471CM
LM339N
LM378
SKT 2 PIN 11
SKT 2 PIN 15
SKT 2 PIN 14
* IC8 PINS 3, 4, 5, 10, 11 & 12




P 15X (X AMP)
P 15X (TIMEBASE)
P 12X (X AMP)
P 12X (TIMEBASE)
0VX
N 12X (X AMP)
N 12X (TIMEBASE)
N 15X (X AMP)
P 15Y (Y AMP)
P 12Y (Y AMP)
0VY
N 12Y (Y AMP)
N 15Y (Y AMP)
P 25E (EHT & PEN DRIVE)
P 5E (EHT)
0VE
+15V
+12V
-12V
-15V
+25V
+5V
MC 78 L12 PC
MC 79 L12 PC
MC 78 L05 PC
2,200µ 25V
2µ2 63V
2 200 µ 40V
BR1
BR2
BR3
ISB05 A
1R/BK
2BK
3
R/BK
LR/BN
5BN
6
R/W
8R/W
7
CN
120 V/BK
100
O/BK
0
BL/BK
120 V
V
0VE
BK
MAINS INPUT CONNECTIONS FOR -
100 V
230/240V

Willow Lane, Mitcham, Surrey CR4 4UL.
Telephone: 01-640 3490. Telex: 946097

GOULD Bryans

Section 4:1
Test schedule – A3 & A4

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **All**

Information contained in this section

Complete test and set-up procedures.

Equipment required for the test procedures:

Insulation Tester – 2kV
Insulation Tester – 500v
Calibrated DC Source 0 – 200 V
Signal Generator 0.1 – 15 Hz
Sine, Square and Triangular Wave Forms 0° and 90° output
Frequency Meter
10 Amp DC Source
Multimeter – 20kΩ per volt.

Voltage selectors must be set to suit mains supply before testing

		Y AXIS SETTINGS		Y AXIS INPUT	X AXIS SETTINGS		X AXIS INPUT	TIME BASE SETTING			
Test No	CHECK FUNCTION	Var. Cont. Range	Input SW.	Signal	Var. Cont. Range	Input SW	Signal	Var. Cont. Range	ACTION	SPECIFICATION	NOTES
1	Mains Isolation	———		———	———		———	———	Apply 2kv Megger test between each supply and EARTH, with Mains Switch ON, supply disconnected	Isolated between LIVE and EARTH, and NEUTRAL and EARTH to be > 20MΩ at 2KV	
2	Input Isolation	CAL 0 1 v/cm	OFF	500v Megger from LO to GROUND	CAL 0 1 v cm	OFF	500v Megger from LO to GROUND	CAL	For each axis apply Megger test between Input LO and GROUND terminals Note reading at 500v	For each axis isolation resistance LO to GROUND to be >20 MΩ at 500v	
3	Mains indicator Graticule Servo mute Pen up	CAL 0 1 v/cm	OFF	——	CAL 0 1 v/cm	OFF	——	CAL 2 sec/cm	Set SERVO to MUTE, Pen to UP and Set Mains Switch ON	Check Mains Indicator on Graticule does illuminated Pen up Check gantry can be moved by hand	
4	Pen lift Paper hold Basic servo & limits operation	As above		——	As above		——	As above	Set Servo to ON operate Pen Lift Operate Pen position controls, Operate PAPER HOLD	Pen lift operates Paper holds Pen can be moved smoothly into limits in both axes	
5	Limit setting	As above		——	As above		——	As above	Operate Pen position controls to move Pen into limits Record all four boundaries	Limit boundary to be plotting area + 1mm min at all four boundaries	Adjust PE, 13 for lower scale limit (X, Y) Adjust P4, 14 for full scale limit (X, Y)
6	Horizontal & Vertical Alignment	As above		——	As above		——	As above	Align a sheet of graph paper with graticules Use pen position controls to draw a line across paper in X then Y direction	Check lines drawn are parallel to gnd lines on plotting paper ± 0 25mm	
7	Writing ability	CAL 0 1 v/cm	ON	Approx 2 8v pk pk 1Hz sine wave	CAL 0 1 v cm	T B	——	CAL 2 sec/cm	Set pen to ½ Y SCALE and to ZERO in X Sweep timebase When plot complete operate reset	Check pen writes over whole plotting area. At end of sweep T B should hold, and pen should lift, On reset gantry should return to origin with pen up	Adjust amplitude of input signal for full coverage of graph paper
8											
9	Calibration X & Y	CAL 0 1 v/cm	ON	2 8v	CAL 0 1 v/cm	ON	3 8v	CAL 2 sec cm	For each axis zero pen apply specified input and record	Deflection in each axis to be f s d ± 0 5mm (0 2% f s d)	X axis calibration set by P2 Y axis calibration set by P12
10	Linearity	CAL 0 1 v/cm	ON	0 - 3 8v 0 2v steps	CAL 0 1 v/cm	ON	0 - 3 8v 0 2v steps	As above	For each axis, zero pen, apply input in 0 2v steps to f s d record each position	Pen deflection for each axis must correspond to input signal ± 0 1% f s d (i e + 0 28 mm in Y ± 0 38 mm in X) 20mm steps	
11	Repeatability	As above		As above	As above		As above	As above	For each axis, zero pen apply input in 0 2v steps to f s d , then 0 2v steps back to zero record each position	Pen deflection for similar inputs must not differ by more than + 0 1% f s d	
12											
13	Range to Range offset	CAL All ranges	OFF (ON)	0 - 2 8v ramp (T B)	CAL All ranges T B (OFF)		——	CAL 2 sec/cm	For each axis, rotate range switch through all positions, with input off during T B "sweep"	Zero position for every range to be within + 1mm	Ramp input required for T B (into Y) when checking X axis (e g use Y pen position pot) X, Y Pre-amp offset - adjust P1, P11 (in board) check TP2, 10
14	Range to Range accuracy	CAL	ON	SEE TABLE 1	CAL	ON	SEE TABLE 1	CAL	For each axis, set range and apply input as TABLE 1, Record deflection Repeat for every range, re zero pen each time	For each range as TABLE 1, deflection to be 100 ± 0 5 mm	
15	Variable range	VAR 0 1 v/cm	ON	2 4v	VAR 0 1 v/cm	ON	2 4v	As above	For each axis apply input with RANGE pot fully clockwise Record deflection	Deflection in each axis to be 80 + 10 mm	
16											

Test No	CHECK FUNCTION	Y AXIS SETTINGS Var. Cont. Range	Y AXIS SETTINGS Input SW	Y AXIS INPUT Signal	X AXIS SETTINGS Var. Cont. Range	X AXIS SETTINGS Input SW	X AXIS INPUT Signal	TIME BASE SETTING Var. Cont. Range	ACTION	SPECIFICATION	NOTES
17	Timebase calibration	CAL 1 v cm	ON	T T L 1Hz square wave	CAL 0 1 v cm	T B	——	CAL 0 5 sec/cm	Sweep timebase, Record > 10 cycles of input (Check frequency of input 1 ± 0 005 Hz on timer)	10 periods of recorded signal to be 300 ± 1 5mm	Calibration set by P7
18	Timebase linearity	CAL 1 v cm	ON	T T L SEE TABLE 2	CAL 0 1 v cm	T B	——	CAL SEE TABLE 2	Sweep timebase, Record number of cycles of input specified in TABLE 2	SEE TABLE 2 Period accuracy 20 + 0 4 mm, 10 + 0 2 mm	Range/Range error may be caused by integrator offset - Adjust P6 (in-board) for ZERO at TP17 when reset
19	Variable range (TimeBase)	CAL 1 v cm	ON	T T L 1Hz square wave	CAL	T B	——	VAR 0 1 sec cm	Set TIMEBASE RANGE pot fully clockwise Sweep timebase record > 1 cycle of input (Check frequency of input 1 + 0 005 Hz on timer)	Period of recorded signal to be 40 + 0 mm 10	
20											
21	Y axis max velocity & overshoot	CAL 1 v cm	ON	1 5v Pk Pk 1Hz square wave	CAL 0 1 v cm	T B	——	CAL 0 1 sec cm	Sweep timebase Record + 1 cycle of input Calculate velocity in each direction	Velocity in slower direction to be 120 cm/sec + 20% 0% Velocity in other direction to be v slow at + 10% 0% Overshoot + 3 mm in each direction	X and Y axis damping set by P5 15 adjust for minimum settling time without exceeding overshoot specification
22	X axis max velocity & overshoot	CAL 0 1 v cm	ON	1 5v Pk Pk 3 2K sec period wave	CAL 0 1 v cm	ON	1 5v pk-pk 1Hz square wve	As above	As above Check frequency of ext Y timebase provides 0 1 s/cm	Velocity in slower direction to be 60 cm/sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot ≤ 4 mm in each direction	As above
23	Y axis max acceleration	CAL 0 1 v cm	ON	0 2v pk pk 15Hz sine wve	CAL 0 1 v cm	T B	——	CAL 0 5 sec cm	Sweep timebase Measure amplitude of trace	Y axis amplitude must be ≥ 8 mm pk pk	
24	X axis max acceleration	CAL 0 1 v cm	ON	1 5v pk pk 3 00 sec period wave	CAL 0 1 v cm	ON	0 2v pk pk 10Hz sine wve	As above	As above	X axis amplitude must be ≥ 8 mm pk pk	
25	Y axis retrace	CAL 1 v cm	ON	1 0v pk pk 0 1Hz wave	CAL 0 1 v cm	ON	1 0v pk-pk 0 1Hz wave	CAL	Record one complete cycle Measure trace separation	Total retrace error must be ≤ 0 5 mm pk-pk	
26	X axis retrace	CAL 0 1 v cm	ON	As above	CAL 1 v cm	ON	As above	As above	As above	Total retrace error must be ≤ 0 5 mm pk-pk	
27	Velocity lag match	CAL 0 1 v cm	ON	1 0v pk pk 1Hz sine wve	CAL 0 1 v cm	ON	1 0v pk pk 1Hz sine wve	CAL	Record one complete cycle Measure minor axis of ellipse	Minor axis of ellipse must not exceed 1 mm	
28	X Y trace noise	CAL 0 1 v cm	ON	1 0v pk pk 0 1Hz sine wave 0	CAL 0 1 v cm	ON	2 8v pk pk 0 1 Hz sine wave 90	As above	Record one complete ellipse (0 + f s d each axis)	Jitter on trace must not exceed 0 5 mm pk pk (Trace to be free of flat spots)	Adjust X or Y gear as appropriate setting for minimum backlash without binding
29	Y I trace noise	CAL 5 v cm	OFF	S C L 0 to GROUND	CAL 0 1 v cm	T B	——	CAL 0 5 sec cm	Record one complete sweep Observe trace noise	Trace noise must not exceed 0 5 mm pk pk (± 0 1% F S D)	
30	Common mode rejection	CAL 0 05 mV cm	ON	Short H I to L O 20 vpp 50Hz sine between L O & GND	CAL 0 05 mv cm	ON	Short H I to L O 20 vpp 50Hz sine between L O & GND	As above	For each axis separately record origin apply input and observe deflection	For each axis deflection at 50 Hz to be ≤ 4 mm pk-pk	
31	Earth continuity	——		——	——		——	——	Apply 10 AMP D C current between EARTH PIN or mains input connector and Electrostatic bedplate support	Voltage drop across test points must not exceed 1 VOLT when measured with Test Meter of 20 kΩ/volt impedance	

Table 1

Range	Input	Range	Input
0 05 mV/cm	0 50 mV	0 1 V/cm	1 0 V
0 1 mV/cm	1 00 mV	0 2 V/cm	2 0 V
0 2 mV/cm	2 00 mV	0 5 V/cm	5 0 V
0 5 mV/cm	6 00 mV	1 0 V/cm	10 0 V
1 0 mV/cm	10 00 mV	2 0 V/cm	20 0 V
2 0 mV/cm	20 00 mV	5 0 V/cm	50 0 V
5 0 mV/cm	50 00 mV	10 0 V/cm	100 0 V
10 0 mV/cm	100 0 mV	20 0 V/cm	200 0 V
20 0 mV/cm			
50 0 mV/cm			

Table 2

Range	f in	Plot length	Periods
0 5 s/cm	1 Hz	300 + 1 5mm (SET)	15
2 s/cm	0 5 Hz	150 ± 3mm	15
10 s/cm	0 1 Hz	50 + 1 mm	5

Test schedule A3 Multi Range continued

Voltage selectors must be set to suit mains supply before testing

		Y AXIS			X AXIS			TIME BASE SETTING			
		SETTINGS		INPUT	SETTINGS		INPUT				
Test No	CHECK FUNCTION	Var Cont. Range	Input SW	Signal	Var Cont. Range	Input SW	Signal	Var Cont. Range	ACTION	SPECIFICATION	NOTES
1	Mains Isolation	———		———	———		———	———	Apply 2kv Megger test between each supply and EARTH with Mains Switch ON supply disconnected	Isolated between LIVE and EARTH, and NEUTRAL and EARTH to be > 20MΩ at 2KV	
2	Input Isolation	CAL 0 1 v/cm	OFF	500v Megger from LO to GROUND	CAL 0 1 v/cm	OFF	500v Megger from LO to GROUND	CAL	For each axis apply Megger test between Input LO and GROUND terminals Note reading at 500v	For each axis isolation resistance LO to GROUND to be > 20 MΩ at 500v	
3	Mains Indicator Graticule Servo mute Pen up	CAL 0 1 v/cm	OFF	———	CAL 0 1 v/cm	OFF	———	CAL 2 sec/cm	Set SERVO to MUTE Pen to UP and Set Mains Switch ON	Check Mains Indicator on Grabcule does illuminated Pen up Check gantry can be moved by hand	
4	Retrieth Paper hold Basic servo & limits operation	As above		———	As above		———	As above	Set Servo to ON operate Pen Lift Operate Pen position controls Operate PAPER HOLD	Pen lift operates, Paper holds Pen can be moved smoothly into limits in both axes	
5	Limit setting	As above		———	As above		———	As above	Operate Pen position controls to move Pen into limits Record all four boundaries	Limit boundary to be plotting area + 1mm min at all four boundaries	Adjust PE, 13 for lower scale limit (X, Y) Adjust P4, 14 for full scale limit (X, Y)
6	Horizontal & Vertical Alignment	As above		———	As above		———	As above	Align a sheet of graph paper with graticules Use pen position controls to draw a line across paper in X then Y direction	Check lines drawn are parallel to grid lines on plotting paper + 0 25mm	
7	Writing stability	CAL 0 1 v/cm	ON	Approx 1 9v pk pk 1Hz sine wave	CAL 0 1 v/cm	T B	———	CAL 2 sec/cm	Set pen to ½ Y SCALE and to ZERO in X Sweep timebase When plot complete operate reset	Check pen writes over whole plotting area At end of sweep T B should hold and pen should lift, On reset gantry should return to origin with pen up	Adjust amplitude of input signal for full coverage of graph paper
8											
9	Calibration X & Y	CAL 0 1 v/cm	ON	1 9v	CAL 0 1 v/cm	ON	2 8v	CAL 2 sec/cm	For each axis zero pen apply specified input and record	Deflection in each axis to be f s d + 0 5mm (0 2% f s d)	X axis calibration set by P2 Y axis calibration set by P12
10	Linearity	CAL 0 1 v/cm	ON	0 +1 8v 0 2v steps	CAL 0 1 v/cm	ON	0 -2 8v 0 2v steps	As above	For each axis, zero pen apply input in 0 2v steps to f s d record each position	Pen deflection for each axis must correspond to input signal + 0 1% f s d (i e + 0 19 mm in Y, + 0 28mm in X) 20mm steps	
11	Repeatability	As above		As above	As above		As above	As above	For each axis zero pen apply input in 0 2v steps to f s d then 0 2v steps back to zero, record each position	Pen deflection for similar inputs must not differ by more than + 0 1% f s d	
12											
13	Range to Range offset	CAL All ranges	OFF(ON)	0 +1 9v ramp (T B)	CAL All ranges T B (OFF)		———	CAL 2 sec/cm	For each axis, rotate range switch through all positions with input off during T B sweep	Zero position for every range to be within + 1mm	Ramp input required for T B (into Y) when checking X axis (e g use Y pen position pot) X, Y Pre-amp offset adjust P1, P11 (in board) check TP2, 10
14	Range to Range accuracy	CAL	ON	SEE TABLE 1	CAL	ON	SEE TABLE 1	CAL	For each axis set range and apply input as TABLE 1 Record deflection Repeat for every range re zero pen each time	For each range as TABLE 1, deflection to be 100 + 0 5 mm	
15	Variable range	VAR 0 1 v/cm	ON	2 4v	VAR 0 1 v/cm	ON	2 4v	As above	For each axis, apply input with RANGE pot fully clockwise Record deflection	Deflection in each axis to be 80 + 10 mm	
16											

Test No	CHECK FUNCTION	Y AXIS SETTINGS Var. Cont Range	Y AXIS SETTINGS Input SW	Y AXIS INPUT Signal	X AXIS SETTINGS Var. Cont Range	X AXIS SETTINGS Input SW	X AXIS INPUT Signal	TIME BASE SETTING Var Cont. Range	ACTION	SPECIFICATION	NOTES
17	Timebase calibration	CAL 1 v/cm	ON	T T L 1Hz square wave	CAL 0.1 v/cm	T B	——	CAL 0.5 sec/cm	Sweep timebase. Record ≥ 10 cycles of input (Check frequency of input 1 ± 0.005 Hz on timer)	10 periods of recorded signal to be 200 ± 1 mm	Calibration set by P7
18	Timebase linearity	CAL 1 v/cm	ON	T T L SEE TABLE 1	CAL 0.1 v/cm	T B	——	CAL SEE TABLE 2	Sweep timebase. Record number of cycles of input specified in TABLE 2	SEE TABLE 2. Period accuracy 20 ± 0.4 mm, 10 ± 0.2 mm	Range/Range error may be caused by integrator offset - Adjust P6 (in board) for ZERO at TP17 when reset
19	Variable range (Timebase)	CAL 1 v/cm	ON	T T L 1Hz square wave	CAL	T B	——	VAR 0.1 sec/cm	Set TIMEBASE RANGE pot fully clockwise. Sweep timebase record ≥ 1 cycle of input (Check frequency of input 1 ± 0.005 Hz on timer)	Period of recorded signal to be 40 ± 0 mm 10	
20											
21	X axis max velocity & overshoot	CAL 0.1 v/cm	ON	1.5v Pk Pk 1Hz square wave	CAL 0.1 v/cm	T B	——	CAL 0.1 sec/cm	Sweep timebase. Record ≥ 1 cycle of input Calculate velocity in each direction	Velocity in slower direction to be 120 cm/sec ± 20% 0% Velocity in other direction to be v slow at + 10% 0% Overshoot ≤ 3 mm in each direction	X and Y axis damping set by P5, 15, adjust for minimum settling time without exceeding overshoot specification
22	X axis max velocity & overshoot	CAL 0.1 v/cm	ON	1.5v Pk Pk 3.00 sec period wave	CAL 0.1 v/cm	ON	1.5v pk pk 1Hz square wve	As above	As above Check frequency of ext Y timebase provides 0.1 s/cm	Velocity in slower direction to be 60 cm/sec ± 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot ≤ 4 mm in each direction	As above
23	Y axis max acceleration	CAL 0.1 v/cm	ON	0.2 pk pk 15Hz sine wve	CAL 0.1 v/cm	T B	——	CAL 0.5 sec/cm	Sweep timebase. Measure amplitude of trace	Y axis amplitude must be ≥ 8 mm pk pk	
24	X axis max acceleration	CAL 0.1 v/cm	ON	1.5 pk pk 3.00 sec period wave	CAL 0.1 v/cm	ON	0.2v pk-pk 10Hz sine wve	As above	As above	X axis amplitude must be ≥ 8 mm pk-pk	
25	Y axis retrace	CAL 1 v/cm	ON	1.0v pk pk 0.1Hz wave	CAL 0.1 v/cm	ON	1.0v pk-pk 0.1Hz wave	CAL	Record one complete cycle Measure trace separation	Total retrace error must be ≤ 0.5 mm pk pk	
26	X axis retrace	CAL 0.1 v/cm	ON	As above	CAL 1 v/cm	ON	As above	As above	As above	Total retrace error must be ≤ 0.5 mm pk-pk	
27	Velocity lag match	CAL 0.1 v/cm	ON	1.0v pk pk 1Hz sine wve	CAL 0.1 v/cm	ON	1.0v pk-pk 1Hz sine wve	CAL	Record one complete cycle Measure minor axis of ellipse	Minor axis of ellipse must not exceed 1 mm	
28	X Y trace noise	CAL 0.1 v/cm	ON	1.9v pk pk 0.1Hz sine wave 0	CAL 0.1 v/cm	ON	2.8v pk-pk 0.1Hz sine wave 90	As above	Record one complete ellipse (0 - 1.5 d each axis)	Jitter on trace must not exceed 0.5 mm pk pk (Trace to be free of flat spots)	Adjust X or Y gear as appropriate setting for minimum backlash without binding
29	Y-1 trace noise	CAL 5v/cm	OFF	S C L O to GROUND	CAL 0.1 v/cm	T B	——	CAL 0.5 sec/cm	Record one complete sweep Observe trace noise	Trace noise must not exceed 0.5 mm pk-pk (± 0.1% F S D)	
30	Common mode rejection	CAL 0.05 mV/cm	ON	Short HI to LO 20 vpp 50Hz sine bet ween LO & GND	CAL 0.05 mv cm	ON	Short HI to LO 20 vpp 50Hz sine bet ween LO & GND	As above	For each axis separately record origin apply input and observe deflection	For each axis, deflection at 50 Hz to be - 4 mm pk-pk	
31	Earth continuity	——		——	——		——	——	Apply 10 AMP D C current between EARTH PIN or mains input connector and Electrostatic bedplate support	Voltage drop across test points must not exceed 1 VOLT when measured with Test Meter of 20 kΩ/volt impedance	

Table 1

Range	Input	Range	Input
0.05 mV/cm	0.50 mV	0.1 V/cm	1.0 V
0.1 mV/cm	1.00 mV	0.2 V/cm	2.0 V
0.2 mV/cm	2.00 mV	0.5 V/cm	5.0 V
0.5 mV/cm	6.00 mV	1.0 V/cm	10.0 V
1.0 mV/cm	10.00 mV	2.0 V/cm	20.0 V
2.0 mV/cm	20.00 mV	5.0 V/cm	50.0 V
5.0 mV/cm	50.00 mV	10.0 V/cm	100.0 V
10.0 mV/cm	100.0 mV	20.0 V/cm	200.0 V
20.0 mV/cm			
50.0 mV/cm			

Table 2

Range	f in	Plot length	Periods
0.5 s/cm	1 Hz	200 ± 1 mm (SET)	10
2 s/cm	0.5 Hz	100 ± 2 mm	10
10 s/cm	0.1 Hz	50 ± 1 mm	5

Voltage selectors must be set to suit mains supply before testing

Test No	CHECK FUNCTION	Y AXIS SETTINGS Var Cont Range	Y AXIS SETTINGS Input SW	Y AXIS INPUT Signal	X AXIS SETTINGS Var Cont Range	X AXIS SETTINGS Input SW	X AXIS INPUT Signal	ACTION	SPECIFICATION	NOTES
1	Mains isolation							Apply 2Kv Megger test between each supply and EARTH with mains switch ON supply disconnected	Isolation between LIVE and EARTH and NEUTRAL and EARTH to be 20MΩ at 2Kv	
2	Input isolation		OFF	500v Megger from LO to GROUND		OFF	500v Megger from LO to GROUND	For each axis apply Megger test between Input LO and GROUND terminals Note reading at 500v	For each axis isolation resistance LO to GROUND to be 20MΩ at 500v	
3	Mains indicator Graticule Servo mute Pen up		OFF			OFF		Set SERVO to MUTE Pen to UP and set mains switch ON	Check Mains Indicator on Graticule dots illuminated Pen up Check gantry can be moved by hand	
4	Pen lift Paper hold Basic servo & limits operation		As above			As above		Set SERVO to ON operate pen lift Operate pen position controls Operate PAPER HOLD	Pen lifts operates Paper holds Pen can be moved smoothly into limits in both axes	
5	Limit setting		As above			As above		Operate pen position controls to move pen into limits Record all four boundaries	Limit boundary to be plotting area 1mm min at all four boundaries	Adjust P3 13 for lower scale limit (X Y) Adjust P4, 14 for full scale limit (X Y)
6	Horizontal & vertical Alignment		As above			As above		Align a sheet of graph paper with graticules Use pen position controls to draw a line across paper in X then Y direction	Check lines drawn are parallel to grid lines on plotting paper 0 25 mm	
7	Writing ability		ON	Approx 2 8v pk pk 1Hz sine wave		OFF		Set pen to Y scale and to ZERO in X Then by use of X offset pot move X axis slowly from 0 to FSD	Check pen writes over whole plotting area	Adjust amplitude of input signal for full coverage of graph paper
8	REMOVE LINKS ON FRONT PANEL P C B									
9	Calibrator A & Y		ON	2 8v		ON	3 8v	For each axis zero pen apply specified input and record	Deflection in each axis to be f s d ± 0 5mm (0 2% F S D)	X axis calibration set by P2 Y axis calibration set by P12
0	Linearity		ON	0 - 2 8v 0 2v steps		ON	0 - 3 8v 0 2v steps	For each axis zero pen apply input in 0 2v steps to f s d record each position	Pen deflection for each axis must correspond to input signal ± 0 1% f s d (i e ± 0 28mm in Y ± 0 38mm in X) 20mm steps	
11	Repeatability		As above					For each axis zero pen apply input in 0 2v steps to f s d then 0 2v steps back to zero record each position	Pen deflection for similar inputs must not differ by more than ± 0 1% f s d	
12	Y axis max velocity & overshoot		ON	1 5v pk pk 3 00 sec period wave		ON	1 5v pk pk 3 00 sec period wave	Record one cycle of input calculate velocity in each direction	Velocity in slower direction to be 120 cm sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot 3mm in each direction	X and Y axis damping set by P5 15 adjust for minimum settling time without exceeding overshoot specification
13	X axis max velocity & overshoot		ON	1 5v pk pk 3 00 sec period wave		ON	1 5v pk pk 1Hz square wave	As above Check frequency of test Y timebase provides 0 15 c m	Velocity in slower direction to be 60 cm sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot 4mm in each direction	As above
14	Y axis max acceleration		ON	0 2v pk pk 15Hz sine wve		ON	1 5v pk pk 1 00 sec period wave	Measure amplitude of trace	Y axis amplitude must be 8mm pk pk	
15	X axis max acceleration		ON	1 5v pk pk 3 00 sec period wave		ON	0 2v pk pk 10Hz sine wave	As above	X axis amplitude must be 8mm pk pk	
16	Y axis retrace		ON	0 1v pk pk 0 1Hz wave		ON	1 0v pk pk 0 1Hz wave	Record one complete cycle Measure trace separation	Total retrace error must be 0 5mm pk pk	

		Y AXIS SETTINGS		Y AXIS INPUT	X AXIS SETTINGS		X AXIS INPUT			
Test No	CHECK FUNCTION	Var Cont. Range	Input SW.	Signal	Var Cont. Range	Input SW	Signal	ACTION	SPECIFICATION	NOTES
17	X axis retrace		ON	1.0 v pk pk 1Hz sine wave		ON	0.1v pk pk 0.1Hz wave	As above	Total retrace error must be ± 0.5mm pk pk	
18	Velocity lag match		ON	1.0v pk pk 1Hz sine wve		ON	1.0v pk pk 1Hz sine wave	Record one complete cycle. Measure minor axis of ellipse	Minor axis of ellipse must not exceed 1mm	
19	X Y trace noise		ON	1.9v pk pk 0.1Hz sine wave 0		ON	2.8v pk pk 0.1Hz sine wave 90	Record one complete ellipse (0 - 1 s.d. each axis)	Jitter on trace must not exceed 0.5mm pk pk. Trace to be free of flat spots	Adjust X or Y gear as appropriate, setting for minimum backlash without binding
20	Common mode rejection		ON	Short H.I to L.O 40 vpp 50Hz sine between L.O & GND		ON	Short H.I to L.O 40 vpp 50Hz sine between L.O & GND	For each axis separately record origin. apply input and observe deflection	For each axis deflection at 50Hz to be ± 4mm pk pk	
21	REPLACE LINKS ON FRONT PANEL P.C.B.									
22	Range to Range offset	UNCAL	OFF		UNCAL	OFF		For each axis, rotate range Pot through full range with input OFF	Pen deflection should not be greater than ± 1mm	
23	Variable range	UNCAL	ON	2.0v	UNCAL	ON	2.0v	For each axis apply input adjust range Pot over full range. Record deflection	Deflection in each axis to be greater than ± 1cm	
24	Earth continuity	———					———	Apply 10 AMP D.C. current between EARTH pin on mains input connector and Electrostatic bedplate support	Voltage deep across test points must not exceed 1 volt when measured with Test Meter of 20 KΩ/Volt impedance	

Voltage selectors must be set to suit mains supply before testing

Test No	CHECK FUNCTION	Y AXIS SETTINGS Var Cont. Range	Y AXIS SETTINGS Input SW	Y AXIS INPUT Signal	X AXIS SETTINGS Var Cont Range	X AXIS SETTINGS Input SW	X AXIS INPUT Signal	ACTION	SPECIFICATION	NOTES
1	Mains Isolation							Apply 2Kv Megger test between each supply and EARTH with mains switch ON supply disconnected	Isolation between LIVE and EARTH, and NEUTRAL and EARTH to be 20MΩ at 2Kv	
2	Input Isolation		OFF	500v Megger from LO to GROUND		OFF	500v Megger from LO to GROUND	For each axis apply Megger test between Input LO and GROUND terminals Note reading at 500v	For each axis isolation resistance LO to GROUND to be 20MΩ at 500v	
3	Mains Indicator Graticule Servo mute Pen up		OFF			OFF		Set SERVO to MUTE Pen to UP and set mains switch ON	Check Mains Indicator on Graticule dots illuminated Pen up Check gantry can be moved by hand	
4	Pen lift Paper hold Basic servo & limits operation		As above			As above		Set SERVO to ON operate pen lift Operate pen position controls Operate PAPER HOLD	Pen lifts operates Paper holds Pen can be moved smoothly into limits in both axes	
5	Limit setting		As above			As above		Operate pen position controls to move pen into limits Record all four boundaries	Limit boundary to be plotting area + 1mm min at all four boundaries	Adjust P3. 13 for lower scale limit (X Y) Adust P4 14 for full scale limit (X Y)
6	Horizontal & Vertical Alignment		As above			As above		Align a sheet of graph paper with graticules Use pen position controls to draw a line across paper in X then Y direction	Check lines drawn are parallel to grid lines on plotting paper ± 0 25 mm	
7	Writing ability		ON	Approx 1 9v pk pk 1Hz sine wave		OFF		Set pen to Y scale and to ZERO in X Then by use of X offset pot move X axis slowly from 0 to FSD	Check pen writes over whole plotting area	Adjust amplitude of input signal for full coverage of graph paper
8	REMOVE LINKS ON FRONT PANEL P C B									
9	Calibration X & Y		ON	1 9v		ON	2 8v	For each axis zero pen apply specified input and record	Deflection in each axis to be f s d ± 0 5mm (0 2% F S D)	X axis calibration set by P2 Y axis calibration set by P12
0	Linearity		ON	0 1 8v 0 2v steps		ON	0 2 8v 0 2v steps	For each axis zero pen apply input in 0 2v steps to f s d record each position	Pen deflection for each axis must correspond to input signal ± 0 1% f s d (i e ± 0 28mm in Y ± 0 38mm in X) 20mm steps	
11	Repeatability		As above					For each axis zero pen apply input in 0 2v steps to f s d then 0 2v steps back to zero record each position	Pen deflection for similar inputs must not differ by more than ± 0 1% f s d	
12	Y axis max velocity & overshoot		ON	1 5v pk pk 1Hz square wave		ON	1 5v pk pk 3 00 sec period wave	Record 1 cycle of input calculate velocity in each direction	Velocity in slower direction to be 120 cm/sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot - 3mm in each direction	X and Y axis damping set by P5 15, adjust for minimum settling time without exceeding overshoot specification
13	X axis max velocity & overshoot		ON	1 5v pk pk 3 00 sec period wave		ON	1 5v pk pk 1Hz square wave	As above Check frequency of ext Y timebase provides 0 1s cm	Velocity in slower direction to be 60 cm/sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot - 4mm in each direction	As above
14	Y axis max acceleration		ON	0 2v pk pk 15Hz sine wave		ON	1 5v pk pk 3 00 sec period wave	Measure amplitude of trace	Y axis amplitude must be 8mm pk pk	
15	X axis max acceleration		ON	1 5v pk pk 3 00 sec period wave		ON	0 2v pk pk 10Hz sine wave	As above	X axis amplitude must be 8mm pk pk	
16	Y axis retrace		ON	0 1v pk pk 0 1Hz wave		ON	1 0v pk pk 0 1Hz wave	Record one complete cycle Measure trace separation	Total retrace error must be - 0 5mm pk pk	

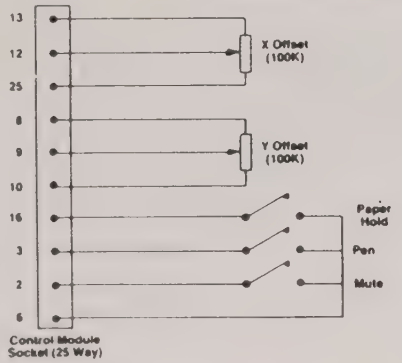
Test No	CHECK FUNCTION	Y AXIS SETTINGS Var Cont Range	Y AXIS SETTINGS Input SW	Y AXIS INPUT Signal	X AXIS SETTINGS Var Cont Range	X AXIS SETTINGS Input SW	X AXIS INPUT Signal	ACTION	SPECIFICATION	NOTES
17	X axis retrace		ON	10v pk pk 1Hz sine wave		ON	0.1v pk pk 0.1Hz ~ wave	As above	Total retrace error must be < 0.5mm pk pk	
18	Velocity lag match		ON	1v pk pk 1Hz sine wave		ON	10v pk pk 1Hz sine wave	Record one complete cycle. Measure minor axis of ellipse	Minor axis of ellipse must not exceed 1mm	
19	X Y trace noise		ON	1.9v pk pk 0.1Hz sine wave 0		ON	2.8v pk pk 0.1Hz sine wave 90	Record one complete ellipse (0 - 1.5 d each axis)	Jitter on trace must not exceed 0.5mm pk pk. Trace to be free of flat spots	Adjust X or Y gear as appropriate, setting for minimum backlash without binding
20	Common mode rejection		ON	Short H1 to LO 40 vpp 50Hz sine between LO & GND		ON	Short H1 to LO 40 vpp 50Hz sine between LO & GND	For each axis separately record origin, apply input and observe deflection	For each axis deflection at 50Hz to be < 4mm pk pk	
21	REPLACE LINKS ON FRONT PANEL P.C.B.									
22	Range to Range offset	UNCAL	OFF		UNCAL	OFF		For each axis, rotate range Pot through full range with input OFF	Pen deflection should not be greater than < 1mm	
23	Variable range	UNCAL	ON	1 0v	UNCAL	ON	1 0v	For each axis apply input, adjust range Pot over full range. Record deflection	Deflection in each axis to be greater than > 1cm	
24	Earth continuity	———	———	———	———	———	———	Apply 10 AMP D.C. current between EARTH pin on mains input connector and Electrostatic bedplate support	Voltage deep across test points must not exceed 1 volt when measured with Test Meter of 20 K Ω/Volt impedance	

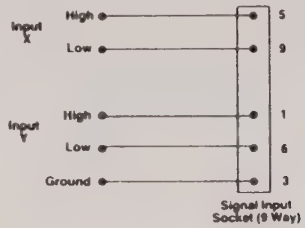
Voltage selectors must be set to suit mains supply before testing

Test No	CHECK FUNCTION	Y AXIS SETTINGS Var. Cont. Range	Y AXIS SETTINGS Input SW	Y AXIS INPUT Signal	X AXIS SETTINGS Var. Cont Range	X AXIS SETTINGS Input SW	X AXIS INPUT Signal	ACTION	SPECIFICATION	NOTES
1	Mains Isolation							Apply 2Kv Megger test between each supply and EARTH with mains switch ON, supply disconnected	Isolation between LIVE and EARTH and NEUTRAL and EARTH to be > 20MΩ at 2Kv	
2	Input Isolation		OFF	500v Megger from LO to GROUND		OFF	500v Megger from LO to GROUND	For each axis apply Megger test between Input LO and GROUND terminals Note reading at 500v	For each axis isolation resistance LO to GROUND to be > 20MΩ at 500v	
3	Mains indicator Graticule Servo mute Pen up		OFF			OFF		Set SERVO to MUTE Pen to UP and set mains switch ON	Check Mains Indicator on Graticule dots illuminated Pen up Check gantry can be moved by hand	
4	Pen lift Paper hold Basic servo & limits operation		As above			As above		Set SERVO to ON operate pen lift Operate pen position controls Operate PAPER HOLD	Pen lifts operates Paper holds Pen can be moved smoothly into limits in both axes	
5	Limit setting		As above			As above		Operate pen position controls to move pen into limits Record all four boundaries	Limit boundary to be plotting area + 1mm min at all four boundaries	Adjust P3 13 for lower scale limit (X, Y) Adjust P4 14 for full scale limit (X Y)
6	Horizontal & Vertical Alignment		As above			As above		Align a sheet of graph paper with graticules Use pen position controls to draw a line across paper in X then Y direction	Check lines drawn are parallel to grid lines on plotting paper ± 0 25 mm	
7	Writing ability		ON	Approx 2 8v pk pk 1Hz sine wave		OFF		Set pen to + Y scale and to ZERO in X Then by use of X offset pot move X axis slowly from 0 to FSD	Check pen writes over whole plotting area	Adjust amplitude of input signal for full coverage of graph paper
8										
9	Calibration X & Y		ON	2 8v		ON	3 8v	For each axis zero pen apply specified input and record	Deflection in each axis to be f s d ± 0 5mm (0 2% F S D)	X axis calibration set by P2 Y axis calibration set by P12
0	Linearity		ON	+ 2 8v 0 2v steps		ON	0 3 8v 0 2v steps	For each axis zero pen apply input in 0 2v steps to f s d record each position	Pen deflection for each axis must correspond to input signal ± 0 1% f s d (i e ± 0 28mm in Y ± 0 38mm in X) 20mm steps	
11	Repeatability		As above					For each axis zero pen apply input in 0 2v steps to f s d then 0 2v steps back to zero record each position	Pen deflection for similar inputs must not differ by more than 0 1% f s d	
12	Y axis max velocity & overshoot		ON	1 5v pk pk 3 00 sec period square wave		ON	1 5v pk pk 3 00 sec period wave	Record 1 cycle of input calculate velocity in each direction	Velocity in slower direction to be 120 cm/sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot - 3mm in each direction	X and Y axis damping set by P5, 15, adjust for minimum settling time without exceeding overshoot specification
13	X axis max velocity & overshoot		ON	1 5v pk pk 3 00 sec period wave		ON	1 5v pk pk 1Hz square wave	As above Check frequency of ext Y timebase provides 0 1s/cm	Velocity in slower direction to be 60 cm/sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot - 4mm in each direction	As above
14	Y axis max acceleration		ON	0 2v pk pk 15Hz sine wve		ON	1 5v pk pk 3 00 sec period wave	Measure amplitude of trace	Y axis amplitude must be + 8mm pk pk	
15	X axis max acceleration		ON	1 5v pk pk 3 00 sec period wave		ON	0 2v pk pk 10Hz sine wave	As above	X axis amplitude must be + 8mm pk pk	
16	Y axis retrace		ON	0 1v pk pk 0 1Hz wave		ON	1 0v pk pk 0 1Hz wave	Record one complete cycle Measure trace separation	Total retrace error must be - 0 5mm pk pk	

		Y AXIS SETTINGS		Y AXIS INPUT	X AXIS SETTINGS		X AXIS INPUT			
Test No	CHECK FUNCTION	Var. Cont. Range	Input SW.	Signal	Var. Cont. Range	Input SW	Signal	ACTION	SPECIFICATION	NOTES
17	X axis retrace		ON	1.0v pk-pk 1Hz sine wave		ON	0.1v pk-pk 0.1Hz sine wave	As above	Total retrace error must be < 0.5mm pk-pk	
18	Velocity lag match		ON	1.0v pk-pk 1Hz sine wve		ON	1.0v pk-pk 1Hz sine wave	Record one complete cycle. Measure minor axis of ellipse	Minor axis of ellipse must not exceed 1mm	
19	X Y trace noise		ON	1.9v pk-pk 0.1Hz sine wave 0		ON	2.8v pk-pk 0.1Hz sine wave 90	Record one complete ellipse (0 → f s d each axis)	Jitter on trace must not exceed 0.5mm pk-pk. Trace to be free of flat spots	Adjust X or Y gear as appropriate, setting for minimum backlash without binding
20	Common mode rejection		ON	Short H1 to L0 40 vpp 50Hz sine between L0 & GND		ON	Short H1 to L0 40 vpp 50Hz sine between L0 & GND	For each axis separately, record origin, apply input and observe deflection	For each axis, deflection at 50Hz to be < 4mm pk-pk	
21										
22										
23										
24	Earth continuity	— — —		— — —	— — —		— — —	Apply 10 AMP D.C. current between EARTH pin on mains input connector and Electrostatic bedplate support	Voltage deep across test points must not exceed 1 volt when measured with Test Meter of 20 KΩ/Volt impedance	

Connection of Signal and Offset Pot's for above tests



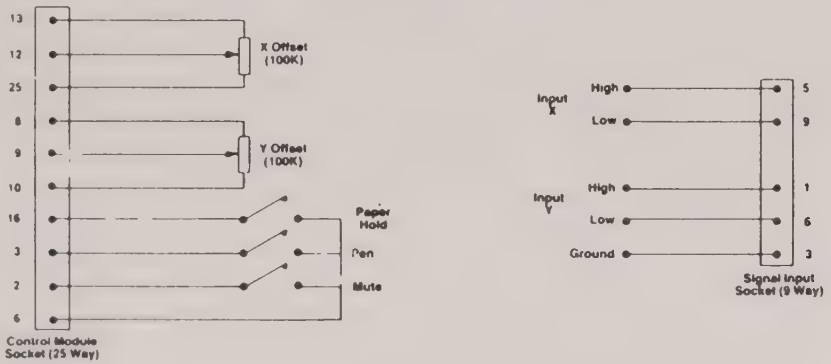


Voltage selectors must be set to suit mains supply before testing

		Y AXIS			X AXIS					
		SETTINGS		INPUT	SETTINGS		INPUT			
Test No	CHECK FUNCTION	Var. Cont. Range	Input SW	Signal	Var Cont Range	Input SW	Signal	ACTION	SPECIFICATION	NOTES
1	Mains Isolation							Apply 2Kv Megger test between each supply and EARTH with mains switch ON, supply disconnected	Isolation between LIVE and EARTH, and NEUTRAL and EARTH to be > 20MΩ at 2Kv	
2	Input Isolation		OFF	500v Megger from LO to GROUND		OFF	500v Megger from LO to GROUND	For each axis apply Megger test between Input LO and GROUND terminals Note reading at 500v	For each axis isolation resistance LO to GROUND to be > 20MΩ at 500v	
3	Mains indicator Graticule Servo mute Pen up		OFF			OFF		Set SERVO to MUTE Pen to UP and set mains switch ON	Check Mains Indicator on Graticule dots illumenated Pen up Check gantry can be moved by hand	
4	Pen lift Paper hold Basic servo & limits operation		As above			As above		Set SERVO to ON operate pen lift Operate pen position controls Operate PAPER HOLD	Pen lifts operates Paper holds Pen can be moved smoothly into limits in both axes	
5	Limit setting		As above			As above		Operate pen position controls to move pen into limits Record all four boundaries	Limit boundary to be plotting area + 1mm min at all four boundaries	Adjust P3, 13 for lower scale limit (X, Y) Adjust P4, 14 for full scale limit (X, Y)
6	Horizontal & Vertical Alignment		As above			As above		Align a sheet of graph paper with graticules Use pen position controls to draw a line across paper in X then Y direction	Check lines drawn are parallel to grid lines on plotting paper ± 0 25 mm	
7	Writing ability		ON	Approx 1 3v pk pk 1Hz sine wave		OFF		Set pen to + Y scale and to ZERO in X Then by use of X offset pot move X axis slowly from 0 to FSD	Check pen writes over whole plotting area	Adjust amplitude of input signal for full coverage of graph paper
8										
9	Calibration X & Y		ON	1 9v		ON	2 8v	For each axis zero pen apply specified input and record	Deflection in each axis to be f s d ± 0 5mm (0 2% F S D)	X axis calibration set by P2 Y axis calibration set by P12
0	Linearity		ON	0 - 1 8v 0 2v steps		ON	0 - 2 8v 0 2v steps	For each axis, zero pen, apply input in 0 2v steps to f s d record each position	Pen deflection for each axis must correspond to input signal ± 0 1% f s d (i e ± 0 28mm in Y ± 0 38mm in X) 20mm steps	
11	Repeatability		As above					For each axis, zero pen, apply input in 0 2v steps to f s d then 0 2v steps back to zero record each position	Pen deflection for similar inputs must not differ by more than 0 1% f s d	
12	Y axis max velocity & overshoot		ON	1 5v pk pk 1Hz square wave		ON	1 5v pk pk 3 00 sec period wave	Record 1 cycle of input calculate velocity in each direction	Velocity in slower direction to be 120 cm/sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot - 3mm in each direction	X and Y axis damping set by P5, 15 adjust for minimum settling time without exceeding overshoot specification
13	X axis max velocity & overshoot		ON	1 5v pk pk 3 00 s- period wave		ON	1 5v pk pk 1Hz square wave	As above Check frequency of ext Y timebase provides 0 1s/cm	Velocity in slower direction to be 60 cm/sec + 20% 0% Velocity in other direction to be v slow + 10% 0% Overshoot - 4mm in each direction	As above
14	Y axis max acceleration		ON	0 2v pk pk 15Hz sine wve		ON	1 5v pk pk 3 00 sec period wave	Measure amplitude of trace	Y axis amplitude must be - 8mm pk pk	
15	X axis max acceleration		ON	1 5v pk pk 3 00 sec period wave		ON	0 2v pk pk 10Hz sine wave	As above	X axis amplitude must be - 8mm pk pk	
16	Y axis retrace		ON	0 1v pk pk 0 1Hz wave		ON	1 0v pk pk 0 1Hz wave	Record one complete cycle Measure trace separation	Total retrace error must be - 0 5mm pk pk	

Test No.	CHECK FUNCTION	Y AXIS SETTINGS Var. Cont. Range	Y AXIS SETTINGS Input SW.	Y AXIS INPUT Signal	X AXIS SETTINGS Var. Cont. Range	X AXIS SETTINGS Input SW	X AXIS INPUT Signal	ACTION	SPECIFICATION	NOTES
17	X axis retrace		ON	1.0v pk pk 1Hz sine wave		ON	0.1v pk pk 0.1Hz ' wave	As above	Total retrace error must be · 0.5mm pk-pk	
18	Velocity lag match		ON	1.0v pk pk 1Hz sine wve		ON	1.0v pk pk 1Hz sine wave	Record one complete cycle Measure minor axis of ellipse	Minor axis of ellipse must not exceed 1mm	
19	X Y trace noise		ON	1.9v pk pk 0.1Hz sine wave 0		ON	2.8v pk pk 0.1Hz sine wave 90	Record one complete ellipse (0 · 1 s d each axis)	Jitter on trace must not exceed 0.5mm pk pk Trace to be free of flat spots	Adjust X or Y gear as appropriate setting for minimum backlash without binding
20	Common mode rejection		ON	Short H1 to L0 40 vpp 50Hz sine between L0 & GND		ON	Short H1 to L0 40 vpp 50Hz sine between L0 & GND	For each axis separately record origin, apply input and observe deflection	For each axis deflection at 50Hz to be · 4mm pk pk	
21										
22										
23										
24	Earth continuity	——			——		——	Apply 10 AMP D C current between EARTH pin on mains input connector and Electrostatic bedplate support	Voltage deep across test points must not exceed 1 volt when measured with Test Meter of 20 KΩ/Volt impedance	

Connection of Signal and Offset Pot's for above tests



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Section 5:1
Consumable spares

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **All**

Information contained in this section

The full range of consumable spares for all 60000 models.

Graph Pad A4	60010/500
Graph Pad A3	60020/500
Fibre Pen – Red	869.011.0020
Fibre Pen – Black	869.011.0021
Lubricating Oil (No other type may be used)	850.200.0012
***Fuse** – 250mA Anti-Surge (240v)	352.250.0106
***Fuse** – 500mA Anti-Surge (115v)	352.500.0104
Complete Accessory Kit	60000/75
I.E.C. Plug with Cable	60000/74

Cleaning Solvent – Industrial Alcohol. Leave for a few minutes to ensure full hold-down on electrostatic bedplate.

*Overload protection for servo motors is built into the drive circuitry.

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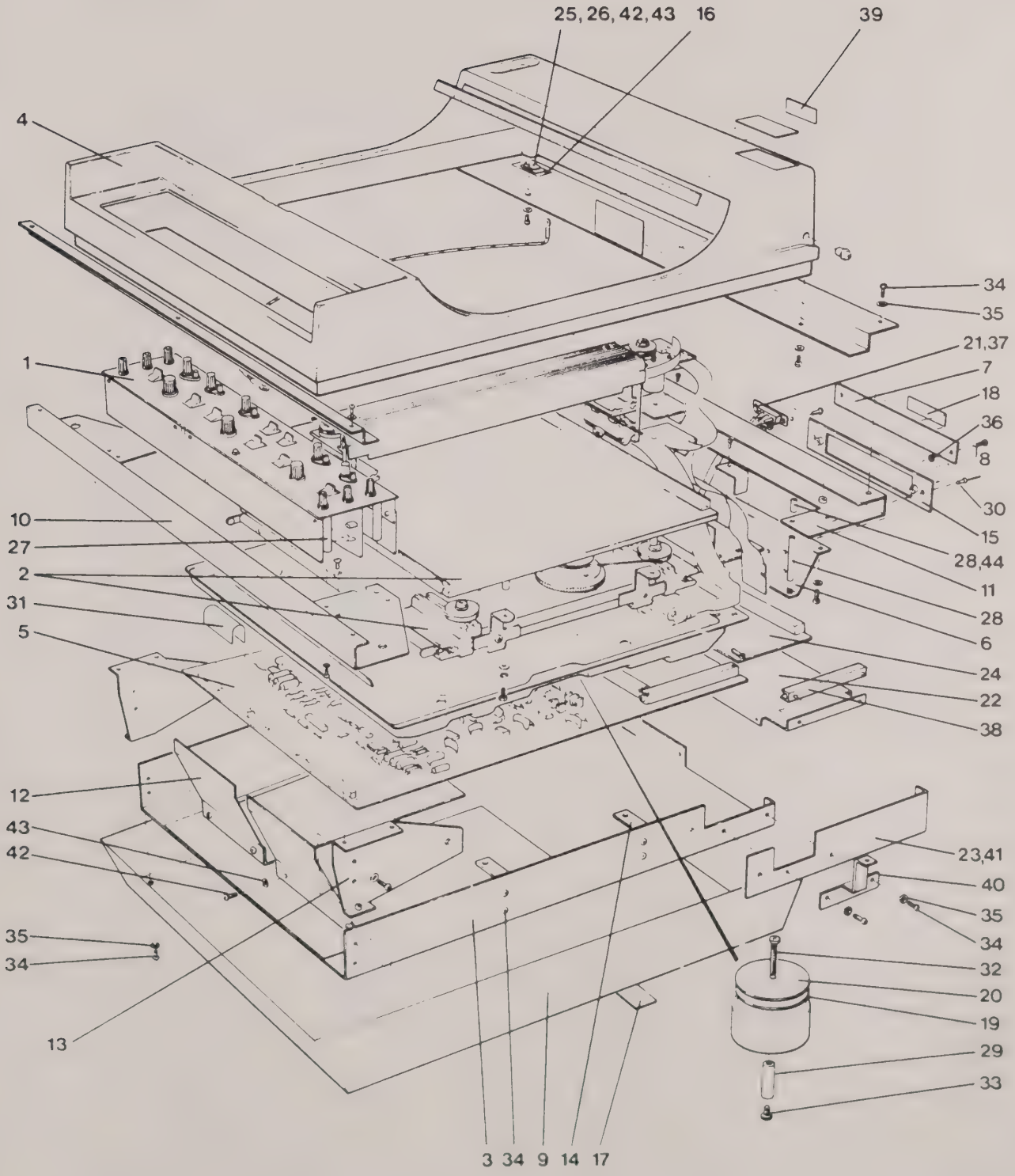
Section 6:1
Rack Mounting

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **Multi Range and Systems**

Information contained in this section

Rack mounting information for A3 and A4 versions of Multi Range and Systems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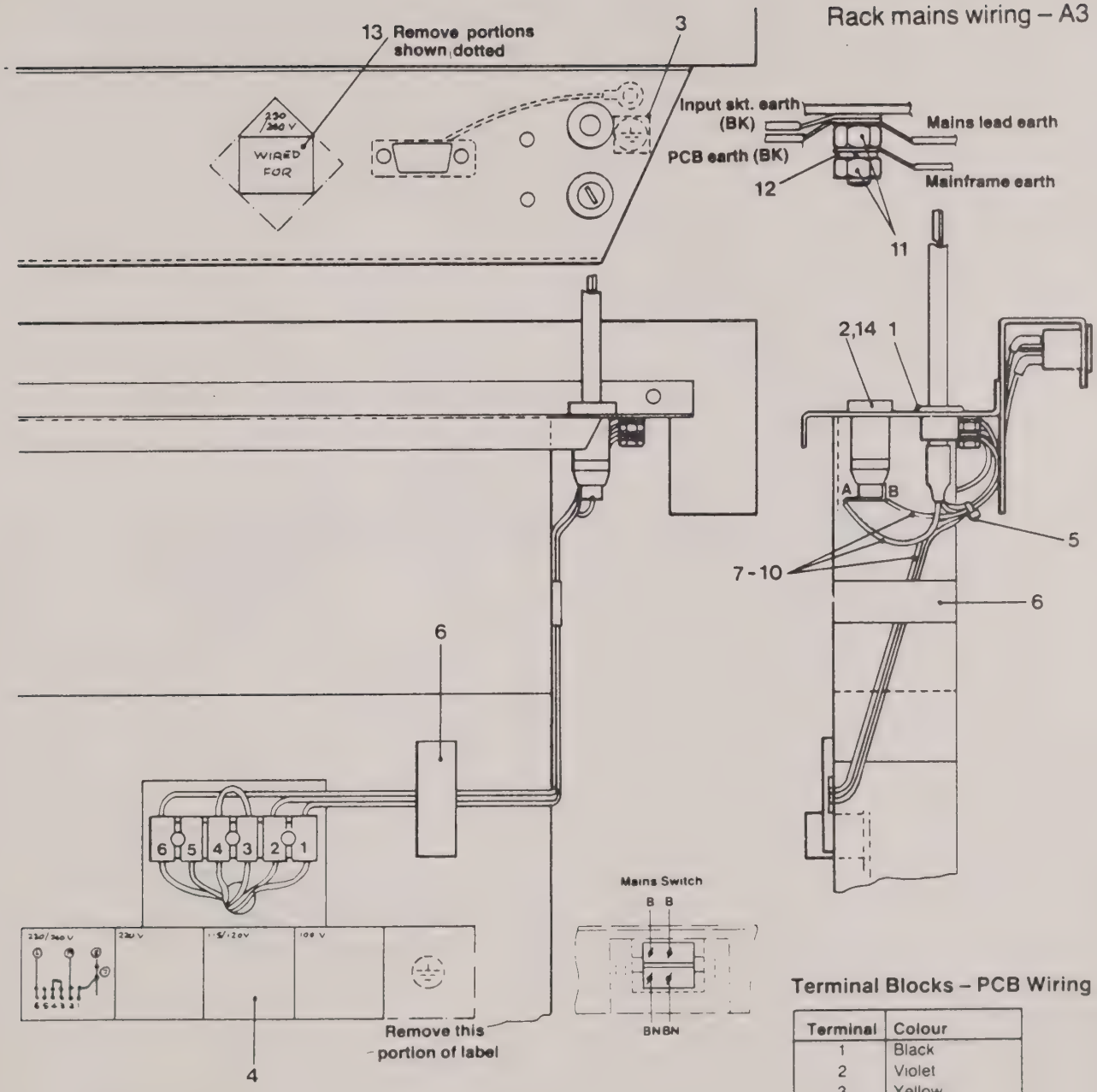
17

Component List

A3 & A4 Rack Mount.

Item	Description	Code No.	Qty
1	Front Panel Assembly (Multi Range)	60000/1	1
	Front Panel Assembly (Systems)	60120/1	1
2	Mainframe Assembly (A4)	60010/1	1
	Mainframe Assembly (A3)	60020/1	1
3	Chassis Assembly	60071/1	1
4	Rack Lid Assembly (A4)	60070/2	1
	Rack Lid Assembly (A3)	60071/2	1
5	Main PCB Assembly (Multi Range)	60020/2	1
	Main PCB Assembly (Systems)	60120/2	1
6	Back Panel	60071/62	1
7	Blanking Plate	60100/504	1
8	Captive Screw	60000/600	2
9	Rear Cover (A4)	60070/501	1
	Rear Cover (A3)	60071/501	1
10	Lower Cross Member	60071/54	1
11	Top Cross Member	60071/55	1
12	Front Panel Screen	60071/56	2
13	Front Panel Bracket	60071/57	2
14	Mainframe Bracket	60071/58	4
15	Adaptor Plate	60071/59	1
16	Mains Switch Label	60071/505	1
17	Rating Label	60071/504	1
18	Warning Label	60000/581	1
19	Transformer Packing Ring	60000/542	1
20	Transformer Clamp Plate	60000/543	1
21	Input Harness Assembly (A4)	60070/4	1
	Input Harness Assembly (A3)	60071/4	1
22	Adaptor PCB Support (A3)	60071/61	1
23	Extender Bracket LH (A3)	60071/60	1
24	Extender Card Assembly (A3)	60020/51	1
25	Switch	355.019.0042	1
26	Sleeve H15 x 15	–	4
27	Spacer Type C M3 x 53	750.008.0262	4
28	Spacer Type R4425–02	750.008.0265	2
29	Spacer Type C M4 x 33	750.008.0264	1
30	Pop Rivet 3.2 x 6.3 Lg	714.000.0001	2
31	Film Strip	–	3
32	Screw M4 x 30 Pozi Pan	–	1
33	Screw M4 x 8 Pozi Pan	–	9
34	Screw M3 x 8 Pozi Pan	–	50
35	Washer M3 Plain	–	38
36	Circlip DIB 1500	719.105.0010	2
37	Nut M3 Hex	–	2
38	Card Guide (A3)	718.100.0120	2
39	Model Identification Label	28800/578	1
40	Offset Mainframe Bracket (A3)	60071/511	1
41	Extender Bracket – RH (A3)	60071/64	1
42	Screw M3 x 6 Pozi Pan	–	12
43	Washer M3 Single Coil	–	6
44	Screw M4 x 6 Pozi Pan (A3)	–	2
	Accessory Kit (Rack)	60071/63	1



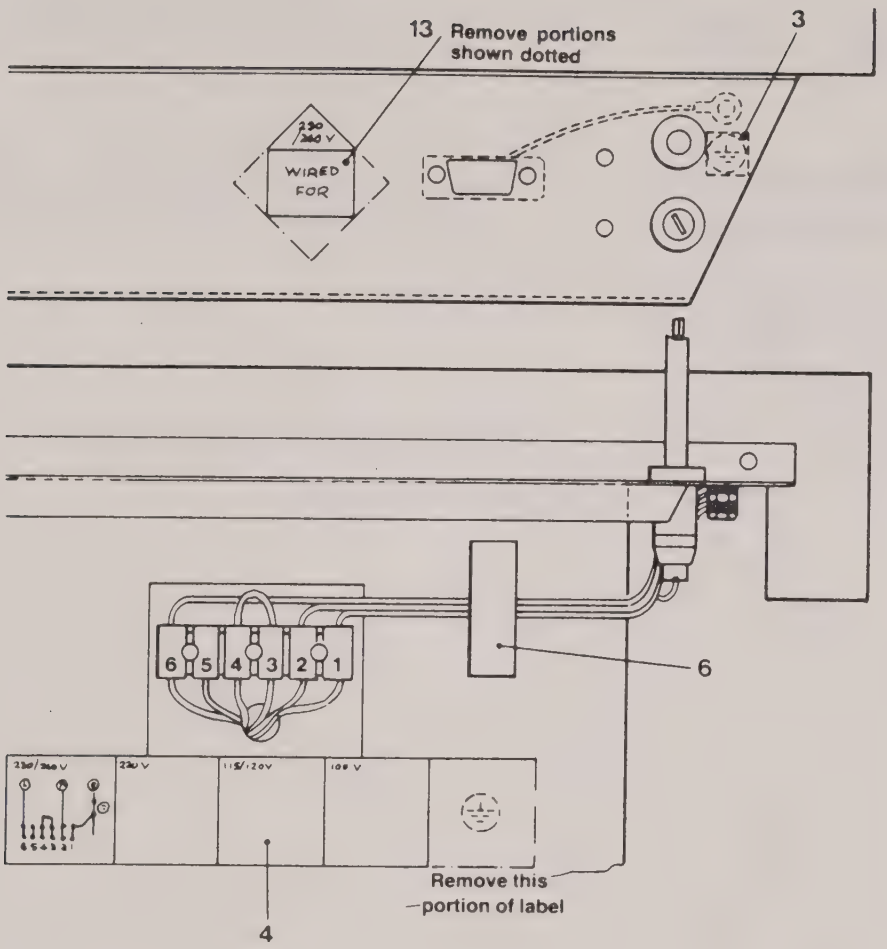
Terminal Blocks – PCB Wiring

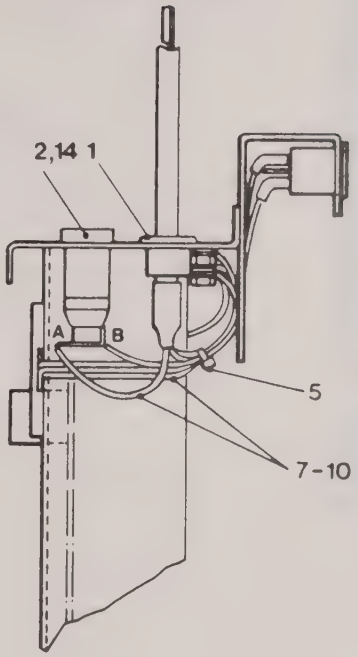
Terminal	Colour
1	Black
2	Violet
3	Yellow
4	Blue/Black
5	Orange/Black
6	Yellow/Black

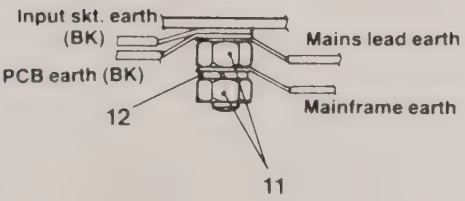
Item	Description	Code No.	Qty
1	Mains Lead Assembly	60000/76	1
2	Fuse Holder	410.001 0004	1
3	Protective Earth Label	60000/580	1
4	Mains Connection Label	60050/501	1
5	Ty-Rap TY23M	718 700 1001	1
6	Cable Clamp	718.100.0121	2
7	Wire 16/0.2 Brown	450 107 1436	A/R
8	Wire 16/0 2 Blue	450 102.1436	A/R
9	Wire 16/0 2 Black	450 101.1436	A/R
10	Wire 16/0 2 Red	450 103.1436	A/R
11	Nut M4 1/2 Hex	–	2
12	Washer M4 Single Coil	–	1
13	Voltage Selection Label	60071/510	1
14	Fuse 500mA	352 500 0104	1

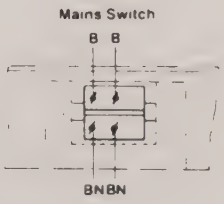
Wiring Schedule

Wire	Colour	From	To
Mains lead	Brown		Fuse A
Mains lead	Blue		Mains switch
Mains lead	Green/Yellow		Earth stud
Input socket earth	Black		Earth stud
Mainframe earth	Green/Yellow		Earth stud
Link 16/0 2	Black	TB1	Earth stud
Link 16/0 2	Brown	TB6	Mains switch
Link 16/0.2	Brown	Fuse B	Mains switch
Link 16/0 2	Blue	TB2	Mains switch
Link 16/0.2	Red	TB3	TB4









Item	Description	Code No.	Qty
1	Mains Lead Assembly	60000/76	1
2	Fuse Holder	410 001 0004	1
3	Protective Earth Label	60000/580	1
4	Mains Connection Label	60050/501	1
5	Ty-Rap TY23M	718 700 1001	1
6	Cable Clamp	718 100 0121	1
7	Wire 16/0.2 Brown	450 107 1436	A/R
8	Wire 16/0.2 Blue	450 102 1436	A/R
9	Wire 16/0.2 Black	450 101 1436	A/R
10	Wire 16/0.2 Red	450 103 1436	A/R
11	Nut M4 Hex		2
12	Washer M4 Single Coil		1
13	Voltage Selection Label	60071/510	1
14	Fuse 500mA	352 500 0104	1

Terminal Blocks – PCB Wiring

Terminal	Colour
1	Black
2	Violet
3	Yellow
4	Blue/Black
5	Orange/Black
6	Yellow/Black

Wiring Schedule

Wire	Colour	From	To
Mains lead	Brown		Fuse A
Mains lead	Blue		Mains switch
Mains lead	Green/Yellow		Earth stud
Input socket earth	Black		Earth stud
Mainframe earth	Green/Yellow		Earth stud
Link 16/0.2	Black	TB1	Earth stud
Link 16/0.2	Brown	TB6	Mains switch
Link 16/0.2	Brown	Fuse B	Mains switch
Link 16/0.2	Blue	TB2	Mains switch
Link 16/0.2	Red	TB3	TB4

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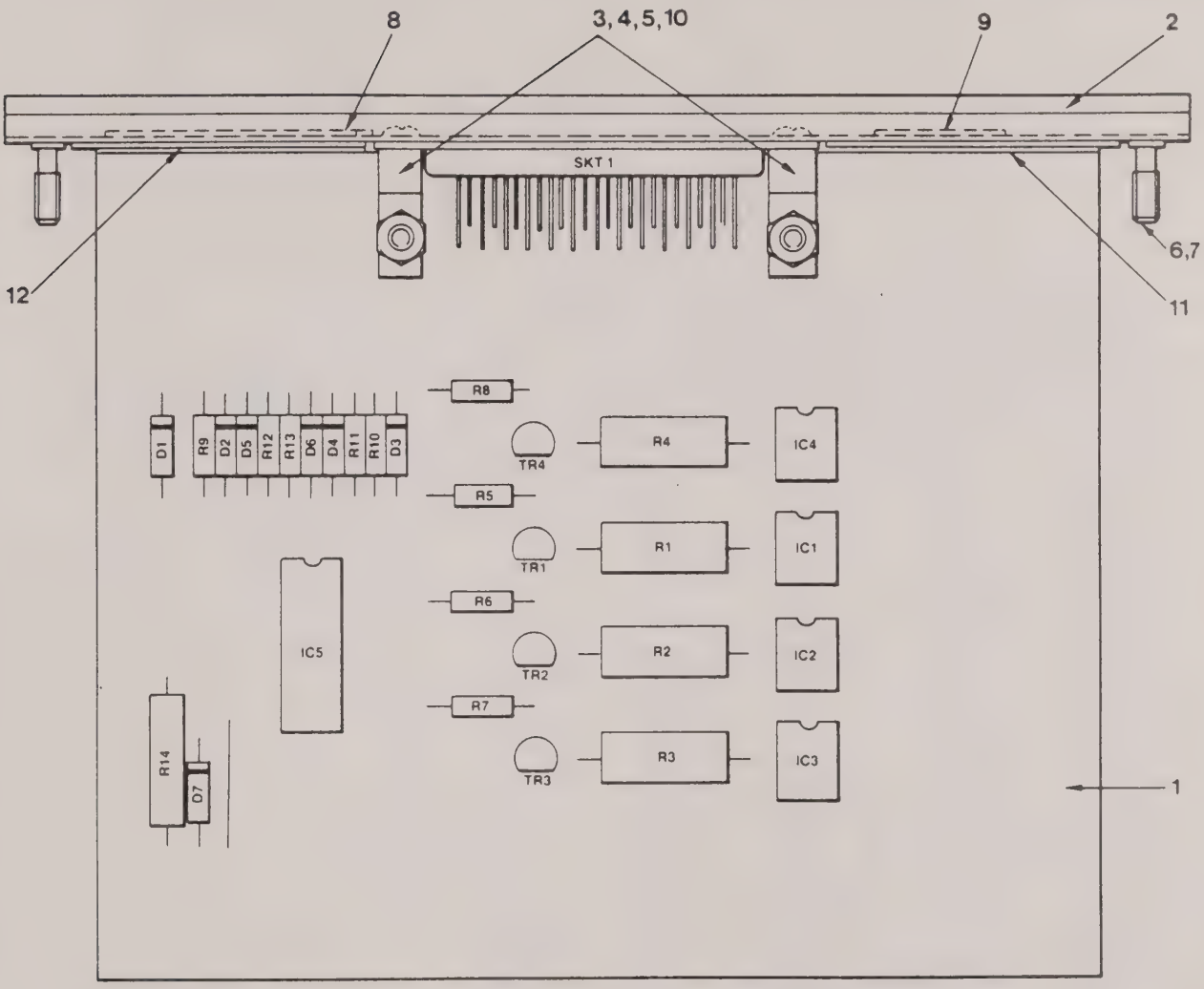
Section 6:2
Personality module

Series 60000 X Y recorder maintenance instructions.

Assembly code:
Exploded illus. line no:
Used on models: **All**

Information contained in this section

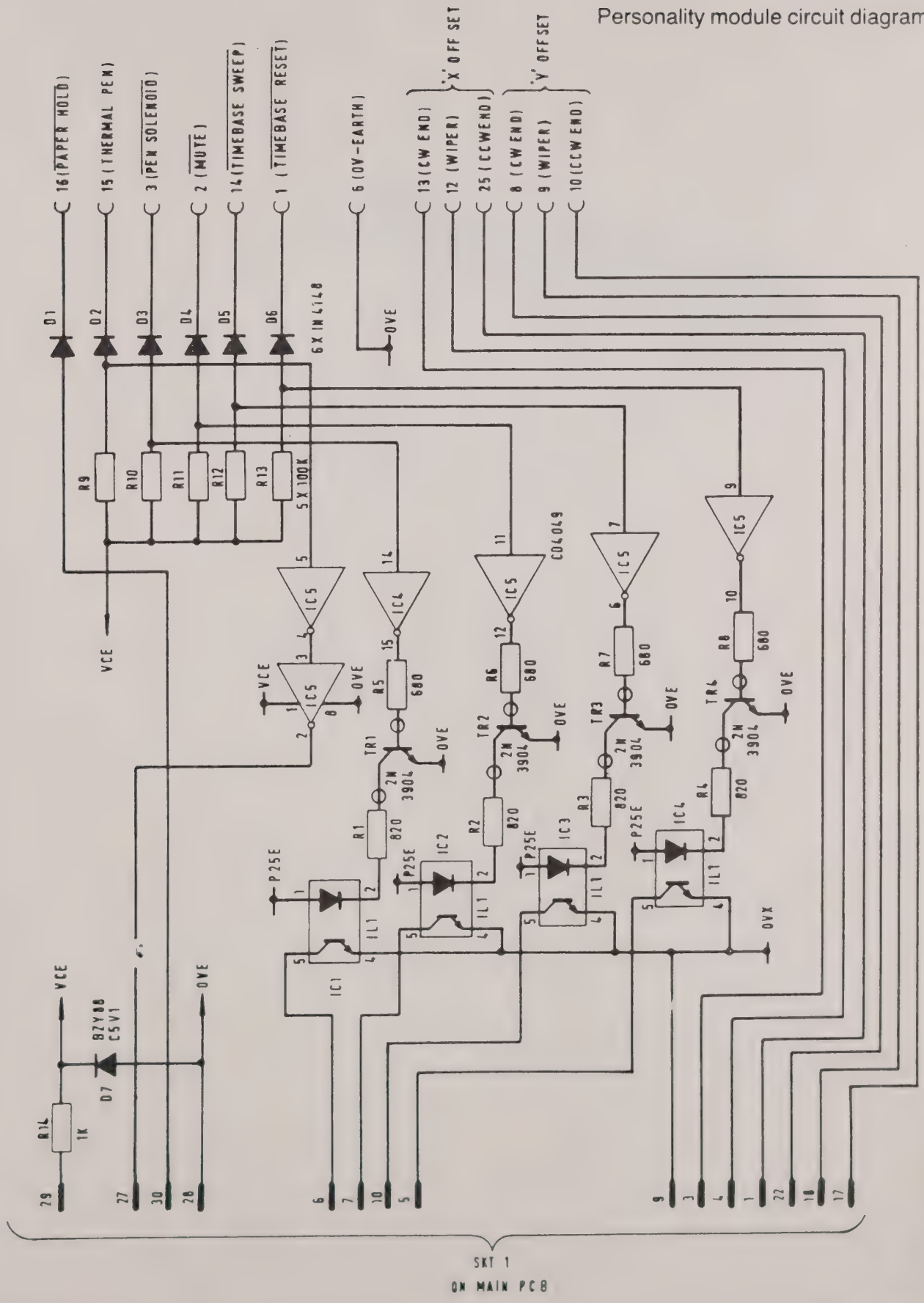


Item	Description	Code No.	Qty
1	PCB Drilling	60100/501	1
2	Back Panel	60100/502	1
SKT 1	D 25 Way Connector	421 614 7033	1
3	Screw M3 x 12 Pozi Pan	–	2
4	Nut M3 Hex.	–	2
5	Washer M3 Single Coil	–	2
6	Captive Screw	60000/600	2
7	Circlip DIB 1500	719 105 0010	2
8	Warning Label	60100/505	1
9	Label	60100/503	1
10	Washer M3 Plain	–	2
11	Serial Number Label	50000/645	1
12	Mod State Label	50000/646	1
–	Plug	420 403 2005	1

Item	Description		Code No.
R11	100KΩ ±5%	⅓W	326 104 2502
R12	100KΩ ±5%	⅓W	326 104 2502
R13	100KΩ ±5%	⅓W	326 104 2502
R14	1K f5%	1.6W	329 102 2102
D1	IN 4148		337 004 0017
D2	IN 4148		337 004 0017
D3	IN 4148		337 004 0017
D4	IN 4148		337 004 0017
D5	IN 4148		337 004 0017
D6	IN 4148		337 004 0017
D7	BZY 88C5V1 ZENER		336 001 0014
–	TINNED COPPER WIRE 22SWG		460 100 0122

			Code No.
R1	820Ω ±5%	1 6W	329 821 2101
R2	820Ω ±5%	1.6W	329 821 2101
R3	820Ω ±5%	1 6W	329 821 2101
R4	820Ω ±5%	1 6W	329 821 2101
R5	680Ω ±5%	⅓W	326 681 2501
R6	680Ω ±5%	⅓W	326 681 2501
R7	680Ω ±5%	⅓W	326 681 2501
R8	680Ω ±5%	⅓W	326 681 2501
R9	100KΩ ±5%	⅓W	326 104 2502
R10	100KΩ ±5%	⅓W	326 104 2502

		Code No.
TR1	2N3904	337 006 0018
TR2	2N3904	337 006 0018
TR3	2N3904	337 006 0018
TR4	2N3904	337 006 0018
IC1	OPTO ISOLATOR IL1	351 091 0106
IC2	OPTO ISOLATOR IL1	351 091 0106
IC3	OPTO ISOLATOR IL1	351 091 0106
IC4	OPTO ISOLATOR IL1	351 091 0106
IC5	CMOS IC 4049 UBE	351 091 0152


16 (PAPER HOLD)
15 (THERMAL PEN)
3 (PEN SOLENOID)
2 (MUTE)
14 (TIMEBASE SWEEP)
1 (TIMEBASE RESET)
6 (0V-EARTH)
13 (CW END)
12 (WIPER)
25 (CCWEND)
8 (CW END)
9 (WIPER)
10 (CCW END)
'X' OFF SET
'Y' OFF SET
D1
D2
D3
D4
D5
D6
6 X IN4148
R9
R10
R11
R12
R13
5 X 100K
VCE
0VE
0VX
IC1
IC2
IC3
IC4
IC5
P25E
IL1
CD4049
R1
R2
R3
R4
R5
R6
R7
R8
820
680
TR1
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TR3
TR4
2N 3904
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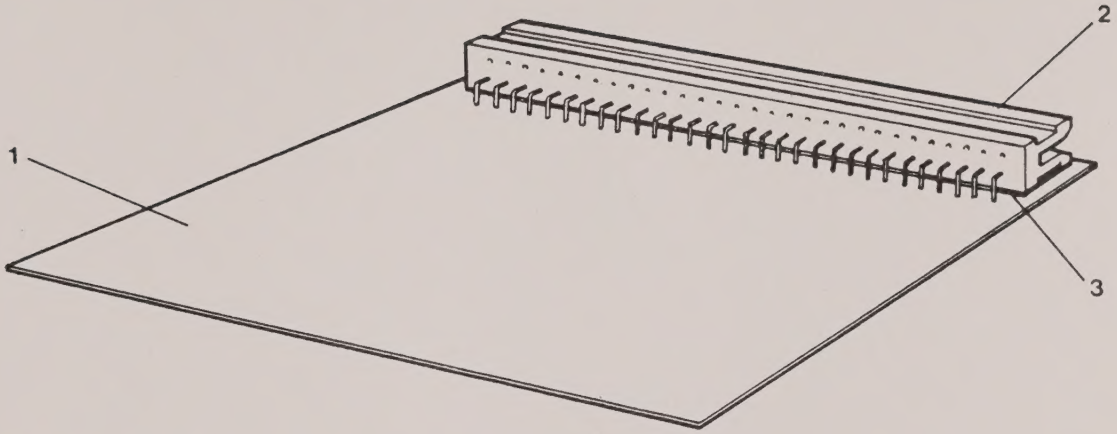
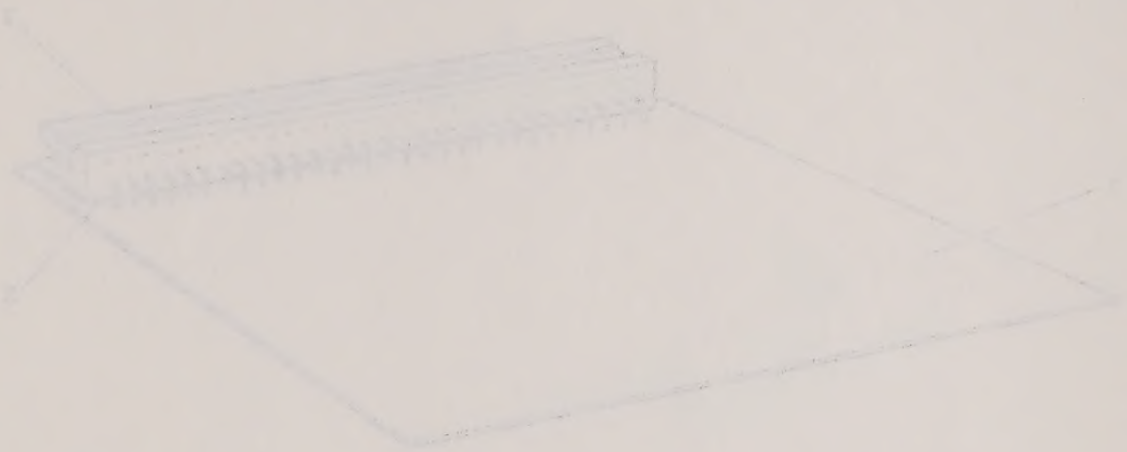
BZY88 C5V1
SKT 1
ON MAIN PCB



Item	Description	Code No.	Qty
1	Extender PCB	60020/521	1
2	Personality Module Connector	60000/587	1
3	Adhesive Tape	885.500.0040	A/R



MP MASTER
MA34620